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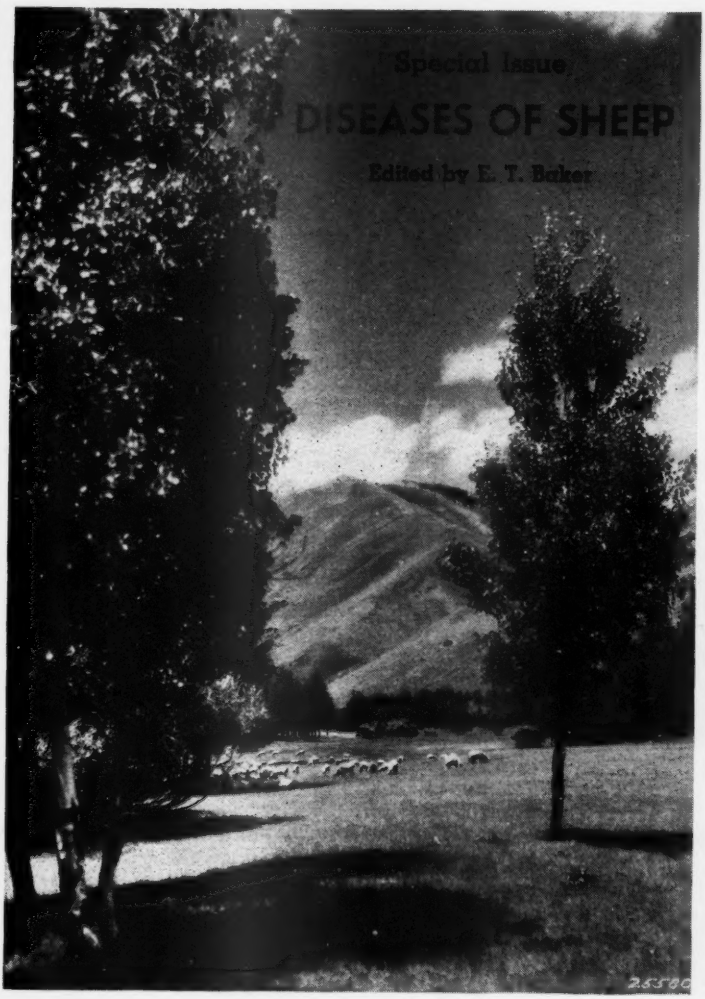

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PUBLISHER'S NOTE—For lack of space, we are compelled to postpone the publication of several articles prepared for this Special issue, including discussions of Diseases of Feed Lot Lambs, by Frank Thorp, Jr.; Poisonous Plants, by A. B. Massey; Obstetrics in Sheep; Administering Medicines to Sheep; Sheep and Goat Lice, and a number of short articles. These discussions will appear in early issues of VETERINARY MEDICINE.

Contributors to This Issue

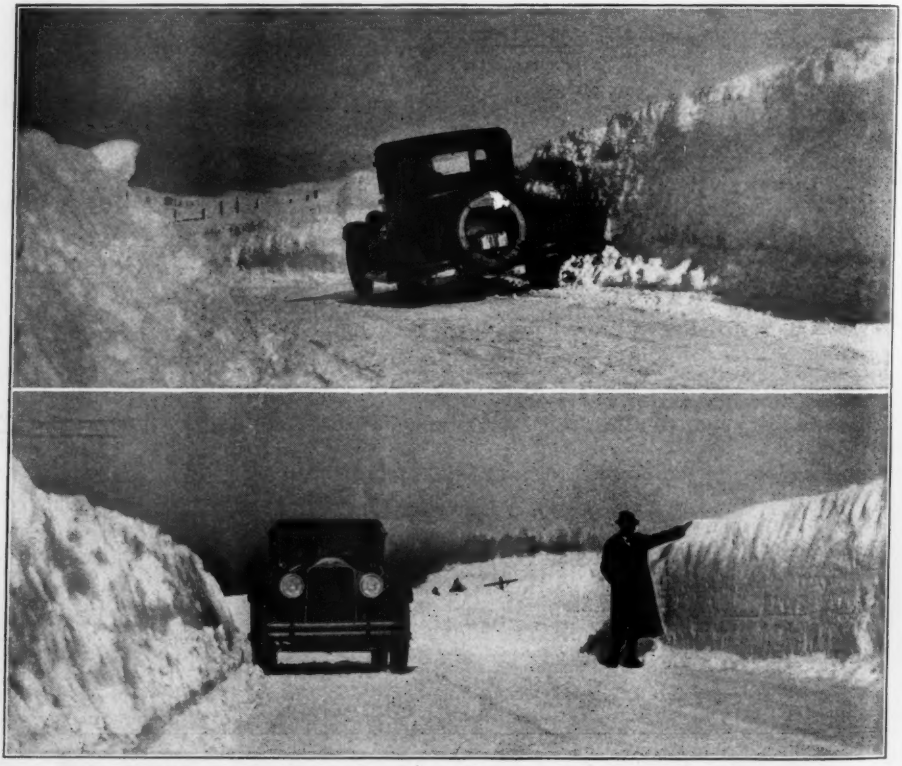
We have been impressed by the neighborly kindness of those invited to contribute. They were only too glad to pass along their knowledge to others who may use it in their work.

We have noticed a return of this feeling among our own clients. A few years ago they were so busy accumulating land or money or speculating they had little time to spare for their less fortunate neighbors. Then, the bubble and the banks "busted," leaving many of them where they had started many years before. They began to realize there were other things in life beside lands or riches. Communities became more neighborly. They had more sympathy for others.

Range Sheep Feeding

To our colleagues who have taken "time off" to help us place this special number before our readers, we say "Thank you."

The good too, that men do lives after them: It is not always "interred with their bones." Marc Antony to the contrary notwithstanding. E.T.B.



Even in early March there is still snow in the Idaho Sheep Country. When the snow lies about six to eight feet deep on the level country and 40 to 60 feet deep in the mountains the ranchers and farmers are happy for it augurs a good wheat yield and good range the following summer.

Proverbs and Maxims

A tethered sheep soon starves.

A black sheep is a biting beast.

The ewe that doth bleat doth lose the most of her meat.

One scabbed sheep's enough to spoil a flock.

One sickly sheep infects the flock,
And poisons all the rest.

February, an ye be fair, the hoggs'll
mend and naething pair;
February, an ye be foul, the hoggs'll die
in ilka pool.

Mony a frost and mony a thowe soon mak's mony a rotten yowe.

Shear your sheep in May, and shear them all away.

Who shears his sheep before St. Gervatius' Day loves more his wool than his sheep.

You may shear your sheep when the elder blossoms peep.

Sheep Husbandry 2300 Years Ago

If sheep are fed salt after parturition, the udder becomes larger.

Sheep fatten on green shoots, vetches, and all kinds of grass, and they fatten more rapidly when their food is salted.

Sheep with wide tails endure the winter better than those with long tails, and short-wooled sheep better than long-wooled, and those with curly wood are more affected by the cold.

Shepherds distinguish the strong sheep during the winter by the frost adhering to their wool, which is not the case with those that are sick; for those that are not strong move about in their weakness and shake it off.

—*Aristotle, "History of Animals."*

In June Sheep are trailed to Forest Preserves in the Mountains

The Author

Know Your Sheep

By JAS. D. GROSSMAN, Columbus, Ohio,
Ohio State University

WE NEED not go far into the past to find a time when the veterinarian was not required to know very much about sheep and their diseases. However, at present, sheep husbandry is a very important branch of the livestock industry and demands veterinary service of high quality. Space limits this discussion to a brief statement of important facts.

In examining the characteristics of different breeds of sheep, we find many in common, but each breed has certain peculiarities that set it off as distinct. On the whole sheep are of two types—mutton type and fine-wool type. The mutton type is further divided into two groups, the long-wool group and the medium-wool group. The various breeds further divide these types and groups.

The chief value of the mutton type lies in its superior capacity to produce a good grade of mutton economically, but production of wool also constitutes an important source of income from a flock of mutton sheep.

The fine-wool type is valued mostly for its ability to produce a good crop of wool, as the carcass it produces is a poor quality of mutton. As a producer of mutton the fine-wool type of sheep compares to the dairy cow in the production of beef.

A few of the breeds of the two types of sheep showing the average weights of the adult male and female of each breed are listed in the following table.

Long Wool
(Mutton type)

Long wool	Ram	Ewe
Cotswold	265 lbs.	200 lbs.
Lincoln	300	275
Leicester	235	180
Romney Marsh	140	115

Medium-Wool Type

	Ram	Ewe
Shropshire	225 lbs.	150 lbs.
Southdown	175	135
Hampshire Down	250	190
Dorset Horn	225	165
Cheviot	200	150

Fine-Wool Type

	Ram	Ewe
Rambouillet	185 lbs.	155 lbs.
Delaine merino	160	125
American merino	140	100

Market Classes

THE following are some of the market terms which are applied to sheep.

Lambs. — Any sheep under twelve months of age.

Prime Lambs.—The most desirable are those weighing about 80 pounds, of good form, quality and finish.

Choice Lambs.—Those ruled out of the prime class because of lack of condition, quality or weight.

Good Lambs.—Those which lack still more quality and condition than choice lambs.

Medium Lambs.—Those faulty in form and not up to standard in quality and condition.

Common Lambs.—Usually those thin, coarse, and rough. The flock may contain some very small ones and also some very large ones.

Hot-House Lambs. — Lambs weighing from 40 to 55 pounds at 8 to 10 weeks of age. They bring the best prices from December to March.

Yearling.—These include yearling wethers only. Yearling ewes and bucks are excluded from this class. The age is determined by the teeth. When the first pair only of permanent incisors are present they are classed as yearlings (see eruption table). The higher grades of yearlings are not overly large and are in prime condition.

Wethers.—This refers to mature wethers. The supply is limited, chiefly because of economical reasons.

Ewes.—Females one year of age and older. On the market they show wide differences in age, condition, and weight. As a rule they dress a lower percentage and the carcass yields less lean meat than wethers, hence they bring a lower price. The higher grades of ewes are relatively scarce. On the market aged ewes are usually found in this group, spoken of as broken mouth ewes.

Feeder Sheep.—These are set off from mutton sheep chiefly by lack in condition.

Breeding Sheep.—These consist chiefly of the younger ewes and rams. Ewes which are satisfactory for breeding are seldom found in the large public markets. One and two-year-old ewes are in greatest demand.

IN CONSIDERING the anatomy of the sheep, only the more important features will be considered. It is more or less common practice to make comparisons with the ox. In many instances the two are much alike and in others they are vastly different.

In some features textbooks give insufficient detail for the practitioner, as, at the time they were written, the sheep had not gained a very important place in the field of practice and were not deemed worthy of extended discussion.

Skeleton

The *vertebral formula* is usually given as $C_7T_{13}L_{6-7}S_4Cy_{16-18}$, but variation in number is common.

The *cervical vertebrae* are seven in number (in all mammals).

The *thoracic vertebrae of the sheep* are commonly 13 in number; 12 have been reported, and 14 is common.

The *lumbar vertebrae* are normally six in number but seven are sometimes found.

The *sacrum* consists of four segments the last of which may not be completely fused.

The *coccygeal vertebrae* present the greatest variation in number from three (in short-tailed or sometimes termed tailless sheep) to 24 or more.

The *ribs* are usually thirteen pairs, but fourteen pairs are common. At the junction of the rib with the cartilage there is a diarthrosis (true joint) in the second to the eleventh pairs inclusive.

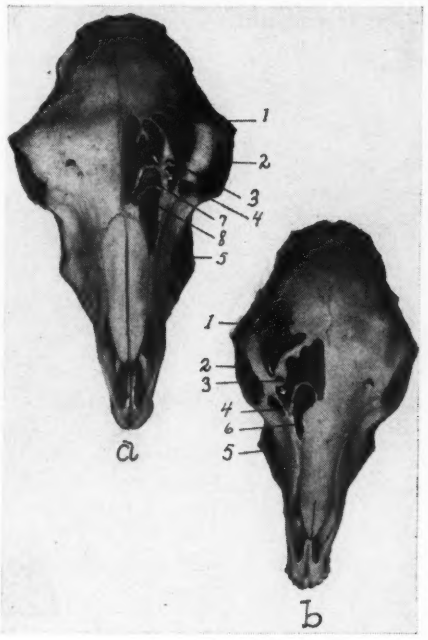


Fig. 1. Sheep Skulls, Dorsal Views

1, Major compartment of frontal sinus; 2, orbit; 3, supraorbital foramen; 4, lacrimal sinus; 5, maxillary sinus; 6, minor compartment of frontal sinus in common with the sinus of the dorsal turbinate; 7, minor compartment of frontal sinus, and 8, sinus of dorsal turbinate.

Arrows indicate course of communication between the two diverticulae of the major compartment.

Of the bones of the skull, the sinuses and the teeth are quite important. The sinuses are involved in certain parasitic conditions. The teeth are observed in age determinations, as well as for judging their soundness.

Frontal Sinus.—There is quite a variation in the arrangement of the frontal sinus of the sheep, but its area and the location of its opening into the nasal cavity are fairly uniform. The posterior extension reaches a transverse plane through the temporal condyles. This plane also marks the posterior extremity of the frontal bone. Anteriorly the sinus extends to a trans-

verse plane through the medial canthi of the eyes. In horned breeds the sinus usually occupies the entire posterior portion of the bone and extends into the horn core to a degree greatest in aged specimens.

The frontal sinus is commonly divided into a major and a minor compartment (1 & 7, fig. 1a) each with its own distinct outlet into the nasal cavity through the ethmoidal meatuses (fig. 3). The major compartment is partially subdivided by numerous septa, one of which is of much importance. It extends from the median plane, at a point through the posterior margin of the orbits, outward and forward to the supraorbital foramen. The supraorbital canal traverses the anterior, free edge of this septum.

The minor compartment may or may not be separate from the sinus of the dorsal turbinate. No. 7, in fig. 1a shows the minor compartment a separate cavity and 6, fig. 1b shows the minor compartment and the sinus of the dorsal turbinate as a common cavity with a common orifice into an ethmoid meatus. The outlets of the frontal sinuses are quite adequate and are somewhat elliptical in outline. The orifices measure about 2.5x4.5mm and 3.5x5.5mm in diameter.

Lacrimal Sinus.—This is a very small sinus placed anteromedial to the orbit in the lacrimal bone. It has a very thin wall, usually partly mucous membrane, separating it from the major compartment of the frontal sinus, and a separate orifice for communication with an ethmoidal meatus.

In making trephine openings, in the frontal region between the orbits, the frontal vein should be avoided. It lies in the frontal groove which extends forward from the supraorbital foramen. The supraorbital foramen is located just behind a transverse plane through the middle of the orbits.

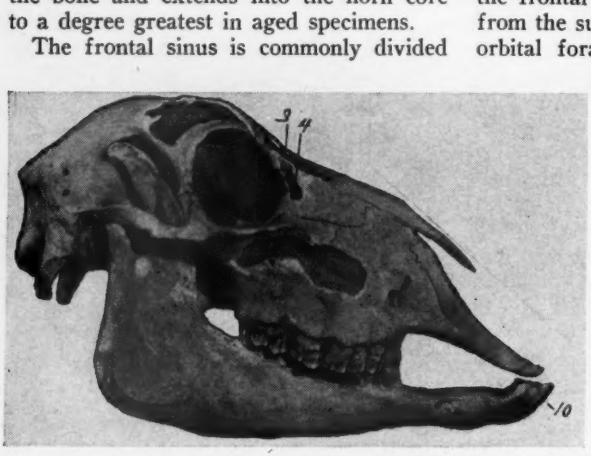


Fig. 2. Skull of Sheep, Lateral View
1, Major compartment of frontal sinus; 2, maxillary sinus; 3, minor compartment of frontal sinus in common with the sinus of the dorsal turbinate; 4, lacrimal sinus; 5, lacrimal fossa; 6, orbit; 7, lacrimal bulla; 8, infraorbital foramen; 9, mental foramen, and 10, incisor teeth.

Maxillary Sinus.—This sinus is located mostly in the maxilla, malar, and lacrimal bones. It extends anteriorly as far as the facial tuberosity, or in aged animals slightly further. The sinus extends posteriorly into the ventral wall of the orbit a little behind its middle ending in the lacrimal bulla (fig. 2, 7). The dorsal limit of the sinus is approximately a line from the infra-orbital foramen to a point just below the medial canthus of the eye.

The maxillary sinus opens into the palatine sinus by a very free, elongated opening just dorsal to the infraorbital canal. The outlet of the maxillary sinus leaves at the upper part, continuing upward, backward and inward to reach the middle meatus of the nasal cavity underneath the anterior free end of the great ethmo-turbinate bone, which partially blocks the opening, (fig. 3, 11). The orifice, elliptical in outline, measures about 7x9mm.

Dorsal turbinate Sinus.—This small sinus is located in that portion of the dorsal turbinate bone which lies beneath the extreme anterior portion of the frontal bone (8, fig. 1a). It may be in common with the minor compartment of the frontal sinus (6, fig. 1b). The outlet is in an eth-

moid meatus (fig. 3, 10).

Palatine Sinus.—A large sinus excavated in the palatine process of the maxilla and the horizontal portion of the palatine bone and situated medial to the infraorbital canal is known as the palatine sinus. It does not reach the median plane.

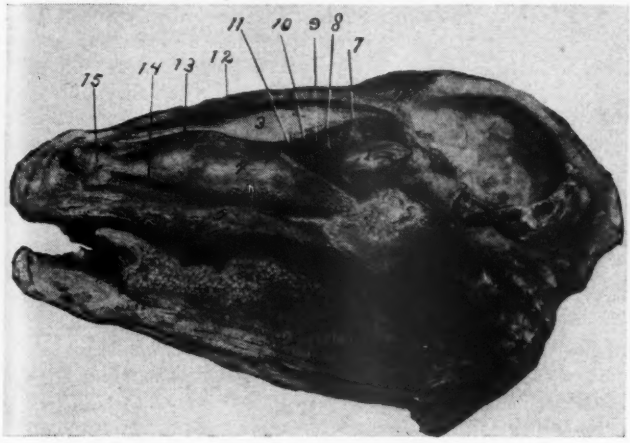


Fig. 3. Sagittal Section of Head of Sheep

1, Great ethmo-turbinate bone turned back; 2, perpendicular plate of ethmoid bone; 3, dorsal turbinate bone; 4, ventral turbinate bone; 5, hard palate; 6, soft palate; 7, position of outlet of major compartment of frontal sinus; 8, position of outlet of lacrimal sinus; 9, position of outlet of minor compartment of frontal sinus; 10, position of outlet of sinus of dorsal turbinate; 11, position of outlet of maxillary sinus; 12, dorsal meatus; 14, ventral meatus, and 15, orifice of naso-lacrimal duct.

It communicates freely with the maxillary sinus over the infraorbital canal and with the nasal cavity is by way of the maxillary sinus and its orifice. It extends forward to the first upper cheek tooth and posteriorly in the hard palate to a transverse plane through the anterior margin of the orbits.

Ethmoid Sinus.—The great ethmoid turbinate is occupied by the ethmoid sinus. It opens into the nasal cavity through an ethmoid meatus.

Digestive System

The sheep belongs to the class of domestic animals classed as ruminants and this accounts for much of the similarity of the anatomy of the sheep and ox.

The *lips* are thin and mobile, and not bare as in the ox except for the well marked philtrum or groove in the upper lip. The thin, mobile lips enable the sheep to graze vegetation too short for other animals.

The *hard palate* is prominent and smooth in the anterior part. Over the body of the premaxilla it presents the thick layer of dense connective tissue which forms the dental pad. Behind the dental pad, there are two narrow depressions, separated by the papilla incisiva, at the anterior ends of which the naso-palatine ducts open. The transverse ridges of the hard palate, about fourteen in number, are smooth on their edges. They do not extend across the width of the palate but alternate or interdigitate at the median line. The posterior part of the hard palate has no ridges. It contains numerous orifices of the ducts of the palatine glands.

The *soft palate* continues back close to the isthmus faucium, but the posterior pillars do not continue to the opening of the esophagus.

The *cheeks* are lined with a mucous membrane which is studded with large papillae, many of which are sharp pointed.

The *tongue* resembles that of the ox in form, but the tip is covered by numerous short blunt papillae.

The sheep, in grazing, does not grasp the vegetation with the tongue and pull it off as does the ox, but cuts off the herbage by the closing of the incisor teeth against the dental pad.

The *dental formula* for the permanent teeth of the sheep, like that of the ox, is

$$2\left(\frac{0}{4}\text{I}—\frac{0}{0}\text{C}—\frac{3}{3}\text{P}—\frac{3}{3}\text{M}—\right) = 32.$$

There are four incisor teeth on either side on the lower jaw and none in the upper jaw. The cheek teeth resemble those

of the ox. The infundibuli of the lower cheek teeth are complete in the ox and sheep, not open medially as in the horse.

The average period of eruption of the teeth is shown in the following table:

ERUPTION OF TEETH

	Temporary Teeth	Permanent Teeth
I^1	At birth or 1st week	1 to 1½ years
I^2	1st or 2nd week	1½ to 2 years
I^3	2nd or 3rd week	2½ to 3 years
I^4	3rd or 4th week	3½ to 4 years
P^1	2 to 6 weeks	1½ to 2 years
P^2		
P^3		3 mos. (lower),
M^1		5 mos. (upper)
M^2		9 to 12 months
M^3		1½ to 2 years

The *salivary glands* resemble those of the ox.

The *parotid gland* is posterior to the mandible and below the ear. The parotid duct emerges from the lower part of the gland and extends forward over the masseter muscle, a little more than an inch above the ventral border of the mandible. It discharges opposite the third or fourth upper cheek tooth.

The *mandibular gland* is posterior and medial to the angle of the mandible. Its duct opens on the floor of the mouth beneath the tip of the tongue on the papillus (caruncula sublingualis).

The *sublingual gland* lies beneath the tongue and consists of two parts. The dorsal part empties by several ducts which open on the floor of the mouth beside the tongue. The ventral part has a single duct, which either joins the mandibular duct or empties in juxtaposition to it.

The *pharynx* resembles that of the ox. The eustachian orifice is situated on the posterior lateral wall of the pharynx on about the level of the ventral nasal meatus.

The *esophagus* is like that of the ox in structure and topography. It is about 15 to 18 inches in length and has a lumen of about one inch when moderately distended.

The *stomach* is similar to that of the ox —compound like all ruminants—but not all compartments are of the same relative size. The average capacity in the sheep is about four gallons.

The *rumen* is the largest of the four compartments; having a capacity of about three gallons. It occupies almost all of the abdominal cavity to the left of the median plane, and when full extends considerably to the right of the median plane. The rumen is divided into two sacs, dorsal and ventral, by the large longitudinal pillar. These sacs are partly divided posteriorly by transverse pillars setting off the posterior dorsal and ventral blind sacs. Anteriorly, the ventral sac has transverse pillars setting off an anterior ventral blind sac. The dorsal is longer than the ventral sac and extends much further forward and also further posteriorly. The parietal attachment extends back as far as the second lumbar vertebra. The rumen is marked on the exterior by grooves which correspond to the pillars of the interior. The mucous membrane is non-glandular and covered by papillae which are rather long and leaf like; varying in length from 1/32 to ¼ inch. The dorsal surface is papillated—not smooth as in the ox.

The *reticulum* is relatively larger than in the ox; having a capacity of about one quart. It is situated mostly to the left of the median plane; lying between the diaphragm and the anterior part of the rumen, omasum and abomasum, and to the left of the liver. Ventrally it contacts the sternal part of the diaphragm; extending forward to the sixth rib. The mucous membrane is arranged in the form of six-sided cells somewhat resembling a honeycomb; these folds are about 2 to 3mm in height and have serrated edges. The reticular or esophageal groove is in general like that of the ox. The reticulum is non-glandular except for some tubulo-alveolar glands at the bottom of the groove.

The *omasum* is the smallest of the four compartments of the stomach. Its capacity is about one pint. It is compressed laterally to the right of the rumen, higher than in the ox, and has no contact with the abdominal wall. It is dorsal to the abomasum and is related on the right to the liver.

The mucous membrane is non-glandular and laminated. But the laminae are less numerous than in the ox. Their free edges face anteriorly and to the left.

The *abomasum* is relatively larger than

in the ox. Its capacity, (twice that of the reticulum), is about two quarts. The anterior blind end lies centrally above the xyphoid cartilage. It extends backward almost parallel to the right costal arch; the pylorus being opposite the ventral part of the eleventh or twelfth intercostal space. The mucous lining is glandular and thrown into well marked folds, arranged in a spiral around the long axis. The abomasum contacts the abdominal floor and is situated mostly to the right of the median plane.

The *intestine,* divided like that of the ox into small and large sections, lies mostly to the right of the median plane.

The small intestine is about 80 feet long and its average diameter is about one inch, the caliber increasing towards the termination where usually an extensive Peyer's patch is found. The duodenum comprises the first three or four feet; the mesenteric part consists of the jejunum and ileum, the former comprises the greater part of the small intestine and the ileum the last three or four feet. There is no definite line of demarcation between the last two divisions. Duodenal glands are found in the first two or three feet beyond the pylorus.

The large intestine consists of the cecum, the colon and the rectum.

The cecum is about 10 to 12 inches long and about 2 to 2½ inches in diameter. It is mostly dorsal to the colon and extends from before backward with the blind end pointing toward the pelvic cavity and may be within the pelvic inlet. It has a capacity of about a quart.

The ileum empties into the anterior end of the cecum and just opposite the ileocecal orifice the colon has its beginning.

The colon is about 15 feet long with a caliber of about 2 to 2½ inches but soon diminishes to about one inch. It is in the form of a double coil which makes two and a half turns. The coils are suspended in the common mesentery above the small intestine and are attached to each other by connective tissue.

The rectum is about three feet long; continuing from the termination of the colon to the anus. It is dorsal to the organs of the genito-urinary system.

The *liver* weighs about 20 to 25 ounces and is situated to the right of the median plane. It is related in front to the diaphragm and in contact posteriorly with the reticulum, omasum, abomasum, pancreas, and duodenum. The gall bladder is long and narrow. The bile duct joins the pancreatic duct to empty into the duodenum about one foot from the pylorus.

The *pancreas* is quadrilateral in shape and mostly to the right of the median plane. As stated, its ducts unite with the bile duct.

The *spleen* is approximately triangular with the base dorsal. It weighs about three or four ounces. It is related to the diaphragm in front and attached to the anterior left face of the rumen.

Respiratory System

In general the respiratory system resembles that of the ox. The line of reflection of the pleura from the diaphragm to the ribs, unlike that of the ox, extends along the seventh and eighth costal cartilages, crosses the ninth cartilage close to the rib, the ventral ends of the tenth and eleventh ribs, the twelfth rib about an inch from its ventral end, and reaches the thirteenth rib about two inches from its lower end.

Important Glands

The *thyroid gland* is dark red in color. It consists of two lateral lobes and an isthmus. The lateral lobes are elliptical in outline and lie on each side of the trachea in relation to the first six or seven rings. The isthmus crosses the trachea about the fifth ring and connects with the lateral lobes near their posterior ends.

Accessory thyroids may be found, and parathyroids occur near the posterior extremity or in the deep face of the lateral lobes of the thyroid.

The *kidneys* of the sheep are bean shaped and smooth. They are about three inches long, two inches wide and one inch thick. The right kidney lies under the first three lumbar transverse processes and the left kidney usually lies to the right of the median plane and beneath the third, fourth and fifth lumbar transverse processes.

The *suprarenal glands* are bean shaped. The right adrenal gland contacts with the anterior part of the medial border of the

right kidney. The left lies in front of the left kidney, sometimes as much as two inches.

The Reproductive System

The *genital* organs of the sheep are much like those of the ox. A few special features will be noted.

The *testicles* of the adult ram are relatively larger than those of the bull. They weigh about nine or ten ounces each.

The *prostate* is entirely disseminate.

The *bulbo-urethral* glands are relatively very large.

The *seminal vesicles* are not bladder-like, but are compact glandular organs with a lobulated surface.

The *urethra* commonly projects about an inch and a half beyond the glans penis.

The *ovaries* of the ewe are almond shaped and about one-half inch in length.

There is no demarcation between the uterine tube and the horn of the uterus.

The *horns* of the uterus are tightly coiled in a spiral and their posterior ends are closely attached to each other. The uterine structure usually lies in the pelvic inlet. The body of the uterus is less than one inch long.

The *cotyledons* are much smaller than in the cow and they have a depression on the free surface.

The *mammary glands* are two in number, and relatively large but flattened on the septal side. Each gland is provided with a small teat with a single orifice.

Rickettsia of Sheep

A new protozoan,[71] named *Rickettsia ovina,* has been described from sheep in Algeria. It is characterized by its frequence in the monocytes of the peripheral circulation. The mortality in this infection is very low. *Phipicephalus bursa* appears to be the agent of transmission.

* * * *

Sway-Back in Lambs

A type of nervous disorder in lambs,[73] locally known as "sway-back" appears to be wide-spread among sheep flocks in Great Britain. A similar, if not identical incoordination has been observed in Sweden, South Africa, Australia, and Peru. The symptoms of the disease are a spastic paralysis particularly of the hind limbs, incoordination of movements, blindness in some cases, a progressive course unassociated with fever, and a generally fatal termination. The characteristic lesion is a diffuse symmetrical degeneration of the cerebral white matter, varying from small foci to that of complete demyelination of the hemispheres. The disease is considered to be in the nature of a progressive degenerative disorder. In many cases the disease begins in the fetus. The possibility that it is always intra-uterine in origin cannot be excluded.

Many of the clinical and pathological features of "sway-back" resemble those of "Schilder's disease" in man. Bacteria, viruses, breeding and deficiency factors are not concerned in the etiology. The causal agent would, therefore, appear to be a toxic factor which is carried by the ewe during pregnancy, and perhaps shortly after birth. This agent causes no obvious disturbance in the health of the ewe, but exerts a pathogenic effect on the fetus or young lamb. The possibility exists also that a heavy metal may be involved in the etiology.

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[71] Lestoquard, F., and Donatien, A. 1936. A new Rickettsia of sheep. (transl. title.) *Bul. Soc. Path. Exot.* 29: 105-108.

[73] Innes, J. R. M. 1937. "Sway-back"—a Demyelinating Disease of Lambs with Affinities to Schilder's Encephalitis in Man. *Vet. Rec.* 48:1539-1549.

Eclampsia is differentiated from lambing paralysis by the extreme nervous condition, and twitching of the muscles and eyes. We give large doses of calcium gluconate and dextrose for this, together with one-twentieth grain each of lobelin and atropin. Keep the animal in a quiet place. Due to not getting the right kind of treatment at the onset, many cases die. In favorable cases, there is rapid improvement in from one to three hours.

Soil-building value of sheep is important. A sheep voids 1500 pounds of manure annually.

Lambs of average size weigh from seven to nine pounds at birth, depending on the breed. Oxford lambs seem largest.

A chilled lamb will respond, remarkably, to warmth, and a few drops of aromatic spirits of ammonia mixed in a little syrup and applied to the tongue or lips.

Thirty-eight acres of sweet clover will support 100 ewes and 90 lambs. A ten-acre field of good pasture will support 25 ewes and their lambs, if a little grain, such as ground oats, is added.

Pregnancy Disease

One year in a sheep's life is equivalent to ten in a person's life. As a rule, a sheep is mature at two, and old or "broken-mouthed" at six or seven.

* * * *

The Westward Expansion of the Sheep Industry

Along in the early Nineties the sheepmen began to gain a foothold on the ranges, especially in the northwestern states. The sheepman was much more able to cope with the elements than was the cattleman. He had his herd under his eye at all times and could move it to better feed before the animals became too weak to travel. In many ways the sheepmen profited by the bitter experience of the cattlemen, and avoided many of their pitfalls. Thus the ranges were divided and in many of the states, especially Wyoming, Montana, Idaho, the sheepmen gradually forced the cattle interests into the background. Bitter range wars followed. Dead-lines were drawn by the cattlemen across which no sheepman could move with his herd. All over the Rocky Mountain region the conflict between the two interests have cost many lives, both human and animal. Then came the demand for some sort of government control of the ranges. The results of regulated grazing upon the various National Forests have been beneficial. Conflicts have been avoided. Depleted ranges have been restored. It is the boast of the Forest Service that not a single hostile shot has been fired between the two interests, nor any stock maliciously killed on the National Forests.—W. C. Barnes (Western Grazing Grounds and Forest Ranges, 1913).

Care of the Farm Flock

By L. J. HORLACHER,
Lexington, Kentucky

THE most common method of improving a flock of sheep and producing good market lambs is to use pure-bred rams on grade ewes. Lambs sired by pure-bred rams are more uniform in color and appearance than lambs sired by scrub rams, easier to fatten, ready for market at an earlier age, dress out a higher percentage, and are worth more per pound on the market.

IT IS desirable to have all ewes bred in a relatively short period, that the lambing season may be short. This decreases the amount of work during the lambing season, and makes all lambs ready for market at about the same time. Also ewes and lambs can be handled much better together when the lambs are of nearly the same age. A short breeding season is encouraged by making certain that the ewes are in good breeding condition and that the ram is strong, healthy, vigorous, and not mated with too many ewes.

The ewes are mated as yearlings (about 19 months of age), so the first lambs are dropped when the ewes are about two years old. The natural breeding season is late summer and fall. With the first cool nights of late summer the ewes begin to come in heat and estrus recurs about every 17 days until they are bred. Since the length of the gestation period is approximately 147 days, ewes bred during the first week of October lamb about the first of March.

At the beginning of the breeding season all tags of wool should be clipped from the hind quarters of the ewes. The toes, if long, need to be trimmed. It is important that the feet of the ram be in good condition. About two weeks before the beginning of the breeding season, give the ewes a little extra feed so they will be gaining in weight when the ram is turned with them. This is called "flushing." It results in a larger lamb crop. The best feed for this purpose is luxuriant pasture.

Small Farm Flock of Choice Sheep

EWES that are properly fed produce an abundant flow of milk when their lambs arrive and are much less likely to disown them than ewes that are poorly fed and the udders of which are not distended with milk. A disowned lamb is a "sorry critter". The proper feeding of ewes aids also in avoiding loss of both ewes and lambs before and after lambing. Ordinarily, ewes do not need grain or roughage during summer and early fall; grass being sufficient. However, at no time while carrying their lambs should ewes be allowed to lose weight. From weaning to lambing time the ewes should gain as much in weight as they will lose in the weight of the lamb and during the suckling period—usually 20 to 25 pounds. The ration of the pregnant ewe should contain plenty of protein and minerals, including calcium—things necessary to the proper development of the fetus. Salt and water are essential at all times.

AS a general rule, the cost of maintaining the flock is reduced by pasturing as much of the year as possible. In this way the sheep gather their own feed and save the expense of harvesting, storing, and feeding, and of scattering the manure. By proper planning pastures can be made available at almost all seasons of the year. Grass, oats and wheat stubble, corn stalks, fall sown rye, wheat, and

barley, spring sown grains, clover, lespedeza, rape, and other crops all can be utilized at some time during the year. It must be born in mind that green grass frequently contains as much as 80% water and that it may be impossible for the ewes to eat sufficient grass to supply the solids necessary for her self and her lamb. Some additional dry feed may be required.

Legume hay is the most satisfactory roughage. It is rich in protein, minerals, and vitamins. The different legume hays are about of equal value if they are fine-stemmed, bright, and leafy when cut, and properly cured. Alfalfa hay is most favored, but clover, lespedeza, and soybean hay are good. Timothy hay, if cut when not more than one-third of the heads are in bloom, is a satisfactory sheep feed. Corn stover is a good roughage, but fibrous and deficient in muscle and blood-building nutrients. Where mangels, rutabagas, and turnips can be grown they make excellent winter feeds. Corn silage makes a good addition to the ration because of its succulence. It may be fed at the rate of two to two and one-half pounds per ewe per day. Moldy silage is dangerous.

EWES that go into the winter in good flesh need little or no grain or other concentrates until three or four weeks before lambing. They should then be fed from one-half to three-fourths pound of grain daily. Grain gives the ewes strength for lambing and provides material for a good supply of milk for the lambs. Among the grains the best for sheep is oats. Oats, like wheat bran, are rich in minerals and in the elements required by the fetus near lambing time. Corn and barley are good feeds when fed with a legume hay or when mixed with other concentrates, such as oats, wheat bran, cottonseed meal, or linseed oil meal. A mixture of equal parts by weight of whole oats and shelled corn is satisfactory for commercial flocks. Well matured sorghum grains are almost equal to corn in feeding value. Whole soybeans are good because they help keep the dung soft.

In addition to proper feeding, shelter, exercise, salt, and water are essential in the management of pregnant ewes. In mild climates little housing is needed; in more severe climates protection from storms is necessary. They require twelve to fifteen square feet of floor space per ewe, exclusive of rack space. As long as the ewes are dry they can stand almost any amount of cold. Exercise keeps the ewes healthy and vigorous and lessens trouble at lambing time.

LAMBING time is the shepherd's harvest. This is the time when he must be on duty day and night. Many problems arise and by being on the job, many lambs can be saved that otherwise might be lost. The ewe may need help. A lamb may become chilled or it may be weak. Lambing pens in a part of the barn that is free from drafts are a valuable means of saving lambs. The ewe may refuse to own her lamb, or there may be an orphan lamb for which a mother must be provided. Some common troubles of the young lamb against which the shepherd must guard are constipation, scouring, pinning, sore mouth, navel infection, and lamb cholera.

The most important factor in determining the rate of gain made by a lamb is the amount of milk it gets. Hampshire lambs grow faster than Southdown lambs and ram lambs grow faster than ewe lambs. The milk flow of the ewe can be stimulated by feeding and the best way to feed a lamb is to provide a good ration for the ewe. In some sections, where pastures are poor, it pays to feed grain to lambs, in a creep. They gain faster, become fatter, and are ready for market earlier than lambs not creep fed. However, if plenty of good pasture is available, creep feeding does not pay. Good clover pasture is excellent for finishing lambs. Lambs that get plenty of milk, range on good pasture, and are kept free from parasites, may be expected to be ready for marketing at three and one-half to five months of age. If they are not fed well or if stunted by diarrhea or other disease their marketable age becomes uncertain and making any profit out of them becomes doubtful.

The Author

Middle Western Sheep Practice

By W. L. ANDREWS, Milton, Iowa

IN our section we have mixed farming of grass, hay and grain. Stock raising includes beef cattle, dairy cattle, sheep, horses and hogs.

The grasses are blue grass and timothy, with the latter cut for seed, and the stubble left for winter pasture. The land is such that most of the blue grass is a permanent pasture.

Our main breeds of sheep are delaines and Shropshires, or a cross of the two.

OF all the problems with which we have to contend in sheep raising the worst is parasites. With permanent pastures, and about 80% of all farms raising sheep, parasites rank first as a pest.

The blow-fly is the most important of the external parasites. From early spring to late fall the flock owner must keep a constant watch for maggots. Ewe lambs are the worst affected, due to the soiling of the wool. Any injury constitutes for them a breeding place. The owner must shear the wool from the affected parts, and apply one of many agents, such as gasoline, turpentine, sheep dip and chloroform. As a preventive, we have found a tar preparation called horn paint to be good. It is a good dispensing agent also.

The sheep tick is another parasite of no small importance. It does its greatest damage to the baby lamb in the spring, with the ticks coming off the ewes and getting on the lambs. We have a few farms with dipping vats. The general method is to shear the ewes, and after the ticks have gone to the lambs, to hand dip the latter. This done annually, and performed carefully, keeps the parasite pretty well under control.

Of the internal parasites, the stomach worm is the king-pin here. The tapeworm is second. Permanent pastures have made them a serious problem. The two are associated so often that we treat for both at the same time. There are various good capsules and preparations on the market, but the following formula has given satisfactory results:

Dissolve one pound copper sulphate in one gallon hot water.

Allow one pound of tobacco to stand in one gallon hot water over night, and strain. In the morning, mix the two solutions.

Mix 23 ounces of this solution with one gallon water, or one to five.

For tapeworm, add one pound kamala to this solution, keeping it constantly stirred till used.

The dose for a lamb is 50cc; for a ewe, 105cc.

Withhold feed from 12 to 24 hours before treatment, and for two hours afterwards.

I prefer the tobacco because it makes a highly colored solution, and is safer to dispense.

We usually begin anthelmintic treatment in June, and the number of treatments required depends on the season. A wet, rainy season makes it necessary to repeat it at least once a month until cold weather. We make it a practice to repeat the first time in ten days or two weeks. It is also a good routine to worm sheep once after zero weather sets in.

We administer the treatment with a four-ounce dose syringe with a

seven-inch, curved dose pipe. The animal is held in a standing position, with the head level or just a little bit higher.

A fine, hair-like lung worm is native to this vicinity, but it is of minor importance. We occasionally get a bad lung worm infestation in western ewes shipped in that are already affected.

OF the infectious diseases, hemorrhagic septicemia is occasionally encountered. Bacterins are specific for a true case of this.

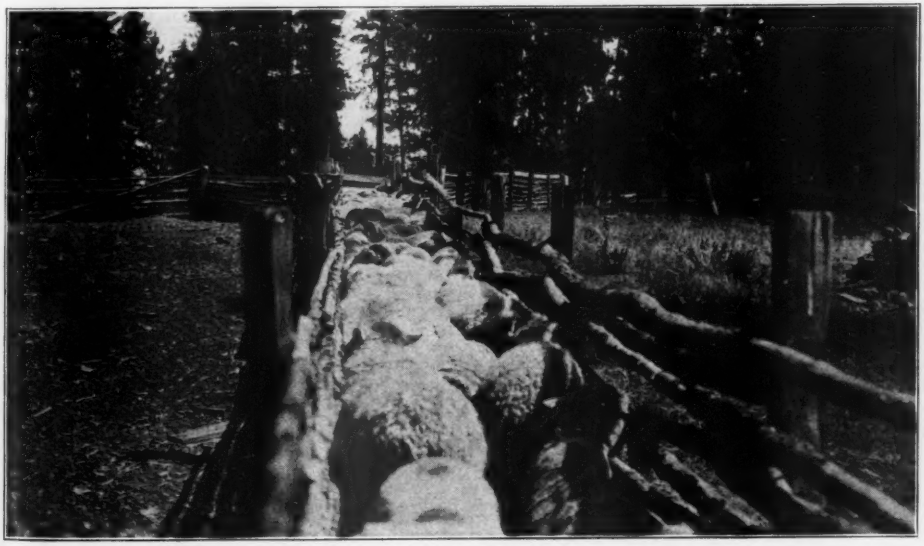
Foot-rot is another infectious disease that seems to be worse when shipped in with western lambs or ewes. Our wet soil favors its development. A milder form seems to be indigenous. Our treatment is to fill a shallow trough with a concentrated solution of copper sulphate and so placed as to compel the animals to pass through it twice a day. Then straw is added; for a sheep dislikes to wade through water. The straw allows the feet to sink down into the solution. The crux of the treatment is not to quit too soon.

OF the breeding ewe and lamb troubles, paralysis of ewes is the worst. Our ewes are bred to have their lambs from January to June. The winter makes paralysis hard to control. It usually occurs in ewes carrying twins or triplets. The first thing we do is to change the diet. If it is low in protein, we add a rich concentrate, such as bone meal and tankage, with a grain ration. We have had plenty to experiment on, but we cannot say that we have ever cured one yet that was very sick.

Scours in lambs is common. We treat it the same as we treat it in calves, using a krameria or bismuth preparation.

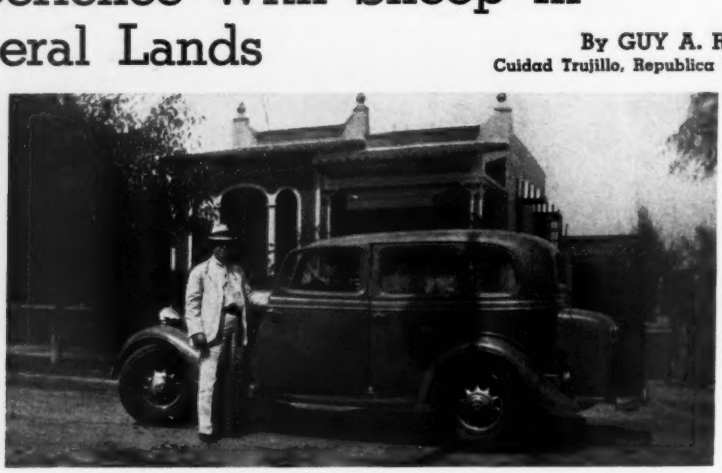
Sore eyes are common, and occasionally assume epizootic proportions. For this, a tube of eye ointment is left, to be used several times daily.

Castration of lambs is best done when the lambs are two weeks to a month of age. We use both the open and emasculatome methods. The open method is done by cutting two thirds of the scrotum off at one clean stroke. The testicles are then grasped with the finger and thumb and jerked out. The wound is painted with any effective fly repellent. In the other method, we pinch on the cord with the emasculatome, and try to snap the testicles off. Failing in this, we crush the cord in two places about one-half inch apart.



Experience With Sheep in Several Lands

By GUY A. ROBERTS,
Cuidad Trujillo, Republica Dominicana



Dr. G. A. Roberts and his home in Cuidad Trujillo

WHILE attending the University of Missouri as an agricultural and medical student in 1895-1901, we were given a job of feeding and caring for the university flock of sheep. It was not long until some of them became weak and died. At this juncture Dr. J. W. Connaway was called in, and it was while admiring his scientific ability and gentlemanly manner, we resolved that if such as he was an animal doctor we would like to be one too.

In North Carolina

In 1903 we went to North Carolina, and on our arrival found only three graduate veterinarians in practice in the whole state. We were an assistant to Dr. Tait Butler, to whom we owe much for help and guidance in our early veterinary career.

While there were fewer sheep in North Carolina than in Missouri, we were in touch with more of them. Here again, we encountered parasites, of which the stomach worm was the most troublesome. We learned too, that the copper sulphate solution had to be used discreetly or it would produce a fatal gastritis.

One interesting observation made at the North Carolina Experiment Station was a case of induced "trembles" or milk sickness in a sheep fed upon white snake root.

Brazil

In 1918 the legislature of the state of Sao Paulo passed a bill providing for the first strictly veterinary college in Brazil, called the "Escola de Veterinaria."

Brazil is a very large country, with an area of 3,285,319 square miles, but except for coastal regions is comparatively sparsely settled. The total population is about fifty million. The capital, Rio de Janeiro, is considered by many to be the most beautiful port in the world. Sao Paulo (the Chicago of Brazil) has a population of over a million. The official language is Portugese; in all other South American countries the official language is Spanish.

The topography of Brazil is quite varied; the north being low and flat; the south quite rolling. The seasons are usually designated as dry (April to September) and wet (October to March).

During our residence in Brazil (nine years) there were about 10,000,000 sheep in the country, most of these being in the cooler southern states. Little effort was made to improve the native sheep, but there were a few good Romney Marsh, Shropshire and Hampshires. Grazing was usually good the year round, with native grasses, molasses grass and alfalfa.

As usual, parasites are the most serious obstacle to sheep raising in Brazil. Ticks, screw worms, grub in the head, warble fly, small liver fluke, hook worms, nodular worms, and lung worms are found there and worst of all, the stomach worm.

Among infectious diseases, foot-and-mouth disease was the most common, but did not do nearly as much damage as in cattle. Rinderpest appeared in a few sheep; anthrax was reported; blackleg existed in two types, and rabies, transmitted by bats sometimes occurred. An infectious diarrhea of lambs was also very fatal.

Predatory animals, including snakes, were also bad. We saw many shed skins of boa constrictors 20 feet long and more than two feet wide. These were said to be able to swallow a good-sized cow after first crushing it thoroughly.

Puerto Rico

In 1929 we were invited to the Polytechnic Institute at San German, Puerto Rico, to establish a department of animal industry there.

It became an insular possession of the United States following the Spanish-American War. Its total area is 3,435 square miles, with a population of nearly two million. Due to the Trade Winds, it enjoys an enviable climate. These delightful breezes prevent excessive heat in the shade, and it never gets cold.

Because of the climate and absence of cheap grazing lands, and a lack of appetite for mutton, sheep are few and far between in Puerto Rico.

Virgin Islands

These were bought from Denmark during the World War for $25,000,000. They could probably be bought for less now. Only three of the 50 islands are large enough to be habitable. Like Puerto Rico, they enjoy a most agreeable climate. St. Croix is the agricultural island of the group. The area is too small to furnish running water. Most people drink rain water, or a "swizzle" of straight St. Croix rum.

The sheep number about 1500, mostly Shropshires, Hampshires, corriedales and African black. As grains and other concentrates are scarce, the sheep feed exclusively on pasture grasses, mostly native.

Important sheep parasites in St. Croix include the lung worm, hook worm, nodular worm, whip worm, tapeworm, and liver fluke. For the latter, we used carbon tetrachloride, 5cc with a small dose of epsom salts, all given in about four ounces of water. Stomach worms were treated with 1% copper sulphate solutions, alternated with 0.5% nicotine and carbon tetrachloride, as for flukes.

We had one rather unpleasant experience with tetanus. We had castrated 29 lambs for the manager of a sugar factory, and about 10 days later, 11 died from this disease. They were operated upon in a grass pasture, but corralled at night in a dusty pen.

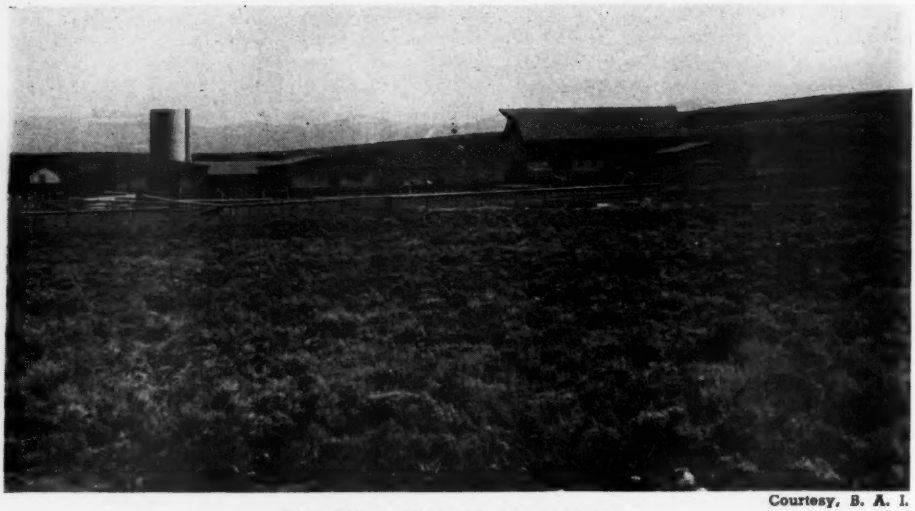
Dominican Republic

The Dominican Republic shares with Haiti the island which lies just east of Cuba. It has a total area of 19,333 square miles. The central and western parts contain high mountains and fertile valleys and plains. It has a population of 1,500,000. About a year ago the name of the capital city was changed to Ciudad (city) Trujillo, in honor of the president. It is a beautiful, clean, progressive city of 50,000. The language is Spanish, and, as in all the West Indies, the climate is delightful the year round.

There are 34,828 sheep and 373,204 goats on the island; this being about the number relation existing between sheep and goats in most tropical countries. Mutton is not relished, and wool cannot be grown profitably. On the other hand, goat meat is greatly prized. One would think that because milk is so rare, goats would be milked, but very few will go to this trouble.

The tropics are not suitable for wool growing and in time Nature modifies the wool of the finest breed to a short hairlike coat.

While many of the common parasites are prevalent, the most damaging is the liver fluke.



Courtesy, B. A. I.

United States Sheep Experiment Station
Left, sheep sheds; right, horse barn; foreground, typical desert range, Dubois, Idaho

The United States Sheep Experiment Station

By STANLEY L. SMITH,
Dubois, Idaho

IN 1915 President Wilson signed an executive order which provided 28,160 acres of land near Dubois, Idaho, for use by the United States Department of Agriculture as a sheep breeding and grazing experimental station, known as the United States Sheep Experiment Station. The object of this undertaking was to furnish assistance to the sheep industry in the solution of problems relating to the improvement of range sheep for efficient production of superior wool and meat, and to determine the most effective methods of using the spring-fall type of range with sheep so as to provide adequate forage without injury to vegetation of value for grazing purposes. The land of this station is typical of the spring-fall range areas in the intermountain region.

In 1922 President Harding signed an executive order which provided an additional 16,650 acres for this station as summer grazing land in Montana, immediately north of the Montana-Idaho state line that forms the northern boundary of the Targhee National Forest. This grazing area is about 40 miles northeast of the station headquarters. This range is used from late June to mid-September. Winter range is provided by permit on the Salmon National Forest about 40 miles southwest of the station headquarters. When feed ceases to be available on the winter range, the sheep are moved to the lower irrigated valleys of the region, where they are fed alfalfa hay for the remainder of the winter. This provides ample range for the station flocks of approximately 3000 sheep, of which about one-third are pure-bred, stud sheep. The results obtained are generally applicable to the range sheep industry.

THE program of experimental work now in progress at this station includes the development and improvement of strains of sheep suitable to the ranges of the intermountain region and to the economic requirements of range sheep producers. Rambouillet, corriedale, and Columbia sheep are being used in these breeding projects. A flock of 500 ewes,

half of which are Rambouillets and the other half corriedales, are being mated to Hampshire and Suffolk rams to test the ability of rams of these breeds as sires of superior mutton lambs under range conditions. The quantity and quality of wool in the fleeces and the mutton conformation of the sheep have been improved steadily and consistently as a result of selective breeding and by a rigid culling policy which eliminates the least desirable sheep each fall. The fleeces of many individual sheep of each breed are studied intensively for yield of clean wool, density, and diameter of fiber, by means of precise laboratory methods. Lambs are also studied intensively for the quantity and quality of their meat including precise laboratory determination. The intensive laboratory work on the wool and meat is conducted by the Bureau of Animal Industry at the National Agricultural Research Center, Beltsville, Maryland, and in laboratories of the Department of Agriculture at Washington, D. C. Feeding trials have been conducted for the past two winters to determine the efficiency of certain breeds and strains within breeds for utilizing locally-grown feeds to produce maximum gains per unit of feed consumed.

WHILE the animal phases of the station's work are conducted by the Bureau of Animal Industry, the program includes much important grazing research in which the Forest Service is conducting intensive vegetation. The Bureau of Animal Industry cooperates with the Forest Service in this work by furnishing sheep and other facilities necessary for a comprehensive study of the technical and practical problems of range utilization.

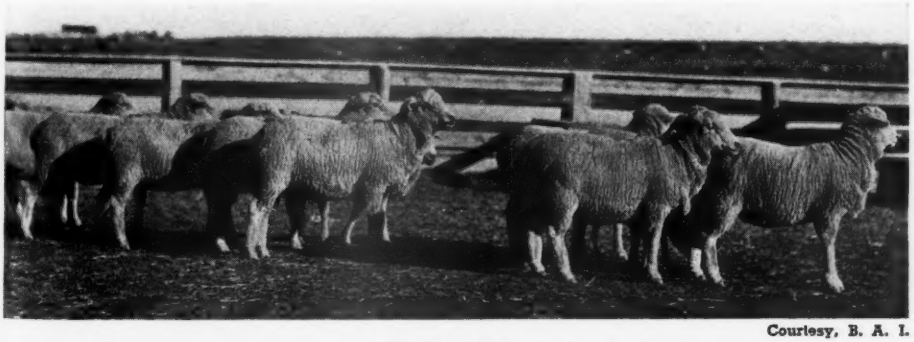
Detailed records kept on each sheep, and by breeds and experimental lots, furnish information which is published in annual reports of the Bureau of Animal Industry and the Forest Service, and from time to time in bulletins and periodicals. The distribution by sale of surplus rams and ewes to interested breeders has made possible improvement in many flocks of Idaho and of other states, often far removed.

Sheep Research

An ideal set-up for sheep research to do worth while work for the wool growers would be to have a group of scientists working as an entity. There is so much to learn about sheep diseases that no one man can handle it, and it would require the cooperation of several branches of science.

A corps of professional workers should include a botanist, a forester, a chemist, a veterinary pathologist, a veterinary bacteriologist, and a field veterinarian to handle the clinical part.

Some of the most important sheep troubles are yet unsolved, and many have hardly been touched upon. Most of our literature along this line is so highly technical that the average practitioner cannot fully understand it.



Courtesy, B. A. I.

Targhee Ewes
Cross-bred, three-fourths fine wool. United States Sheep Experiment Station, Dubois, Idaho

Big Head, Solar Eczema or Photosensitization of Sheep

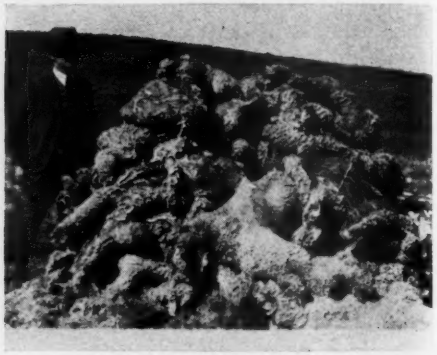
By W. H. LYTLE, Salem, Oregon

THIS highly destructive ailment involving the face tissues and skin covering of sheep is doubtless primarily an angioneurotic or deep-seated eczema caused by an allergic reaction to certain, protein-rich forage.

The pathology surrounding this ailment is, in its present stage of development, highly speculative. That there is a photosensitization or sunlight injury, there can be no doubt. The exposed tissues of the face and the wool free surface of any injured part of the body that may be exposed to the sun in these photosensitized sheep, undergo a reaction with the various stages of a deep-seated eczema—first the swelling of the skin, followed by exudation of serum into the skin and the subcutaneous tissue and finally a dry necrosis and a shedding of the skin in cases that survive.

THE losses of winter ranged sheep in some sections of the northwest have been staggering—as many as 10,000 sheep have been lost in a single year in two Oregon counties, and vast areas of range land in Nevada, Idaho, Utah and Oregon are now regarded as unsafe for the winter and spring grazing of sheep. The losses due to this necrotic skin involvement are enhanced because of certain necessities of the range handling of sheep. Many of these cases die getting well, so to speak.

In range lambing ewes, the malady is devastating as the skin of the face, as soon as the swelling subsides, undergoes dry gangrene and hardens like sole leather generally leaving the eyelids temporarily closed and the animal blinded to wander away and die from exhaustion and the lamb, if any, to starve.



Pelts from Big Head Victims. More than 2,000 sheep died of big head on this range

THE causative factors are primarily dietetic. Just what complications are present opens up wide speculation. The investigations that have been carried on by Dr. A. B. Clawson, physiologist of the stock poisoning plants division of the U. S. Bureau of Animal Industry, seems to indict as to the primary etiologic agent, the Tetrademia family of desert shrubs which are known by various names such as rabbit brush, horse brush, etc.

When desert forage is scarce, as has been the case the past few years, sheep browse the green leaves of these shrubs which are thought to contain an irritating substance, which being eliminated through the liver, causes a slow inflammation resulting in cellular infiltration around the walls of many of the larger bile ducts resulting in their thickening and a form of hepatitis.

There also is sloughing of the mucous lining of the gall bladder and in some cases necrosis. Thickening of the bladder wall is always found on autopsy of cases showing the face-skin symptoms. The swelling of the mucous lining of the gall bladder and common bile duct is the probable cause of the photosensitization which comes about when green rich chlorophyl carrying grasses are consumed and later enter the constituents of the bile, which

Autopsy on a Victim of Big Head. Dr. A. B. Clawson, right; Dr. W. H. Lytle, left

dams up in the gall bladder because of the swelling and occlusion of the common bile duct, the bile entering into the circulation through absorption by the lymphatic system, and chlorophyl or some physiologically incompleted form of chlorophyl being the photodynamic substance.

Big Head
Showing necrosis of the skin of the face and blindness

Young lambs after they have been on green feed for three or four weeks, often die from shock that probably comes about in a somewhat similar manner. There is always the possibility that lambs may have some common bile duct occlusion due to masses of parasites such as the round or flat worms, but the fact that the loss occurs in the lamb when it has been on green grass for about the proper time to become sensitized before the fatal shock occurs, seems to indicate that an allergic reaction first takes place causing the liver dysfunction, which in turn is followed by the photosensitization sequelae. Mature sheep die also from shock without showing the skin necrosis symptoms. These are generally shorn sheep with the skin having less wool protection than young lambs.

TREATMENT resolves itself into shielding the animals thus rendered light sensitive from bright sunshine. The intensity of the sun's rays is augmented by a reflection from water, snow or white sand. Sheep men report that the greatest number of cases appear in the early spring when the sun comes out bright following a rain or flurry of snow. The rain possibly

clears the air of dust particles that might arrest some of the chemic rays. In valley districts, where sheep are pasture run, by stabling them during the period of the day when the rays of the sun are intense, stops the lamb losses. On the open range, there are no buildings for housing purposes, hence, having dense sagebrush available for sunlight shading purposes, affords some protection against these losses, particularly bighead. Using black-face sheep and shearing late in the season also is helpful.

Applying an ointment of 10 parts lampblack, 10 parts tannic acid, 1 part lysol and a half each lanolin and petrolatum base, protects and cures many of the light-injured faces of the sensitized sheep and prevents the skin hardening and blindness. Liver function dye tests might be used in the late winter months to determine if the livers had been injured and the necessity for precautionary measures. A system of desensitization to various plant materials could doubtless be worked out, making use of either a series of intradermal desensitizing injections or the graduated feeding of concentrated desensitizing agents.

* * * *

The Suffolk is a typical mutton type sheep, with no horns, and perhaps the darkest face of any breed.

The Corriedale was developed in New Zealand in 1880 by crossing Lincoln rams with merino ewes. The lambs furnish fine mutton, being known in the English trade as "Canterbury lamb." They are light-faced and hornless.

The Karakul is a fur-bearing, hornless breed, also known as the Astrakhan. They bear jet-colored lambs, the pelts of which furnish the well known Persian, broadtail or Astrakhan fur.

Lesser Known Breeds of sheep include over a dozen breeds raised in various regions of the world, mostly in the British Isles.

The Oxford is a cross of the Cotswold with the Hampshire and has been recognized as a distinct breed since 1854. They have a very light brown face and no horns.

The Dorset was recognized as a distinct breed in 1840. It is a white-faced, mutton type. Both sexes possess large horns. They produce two crops of lambs per year, and are very hardy.

The Cheviot is one of the most beautiful of all breeds of sheep, with the alert appearance of a thoroughbred. They are white-faced and hornless.

A Veterinarian's Home in Moscow, Idaho

Sheep Problems in the Southwest

During the past few winters, a considerable quantity of mixed infection bacterin

Individual Treatment of Foot Rot

(ovine) has been used in New Mexico sheep for pneumonic disturbances, attended with inflammatory conditions of the intestinal tract. Moving of these bands does not, alone, control the condition. However, with the addition of the mixed bacterin, prompt control results.

The feet are soaked in "red oil"—gum camphor 2 oz.; sulphuric acid 1 oz.; turpentine 1 qt.; oil eucalyptus 1 oz., and q. s. red oil color.

New Mexico sheep raisers generally are not alert to the value of proper veterinary service. Sheep have been run, largely, on the open range for years. Heretofore, in this dry climate conditions have been unfavorable for the development of epizootics or the rapid spread of certain parasites.

TOM SNELL.
State Sheep Inspector.
Albuquerque, New Mexico.

Protection for Baby Lambs

Pneumonia frequently occurs in lambs, nearly always from chilling. Treatment is generally unsuccessful, but the disease may be prevented through the use of hot water jugs or milk cans filled with warm water and placed in a box or barrel, thus furnishing the lambs with a brooder. Valuable lambs may be protected by using wide flannel belly bandages held in place with safety pins over the back for a couple of days.

A "Bum Lamb"
Western parlance for orphan lamb

The first four days are a critical period in the life of the average, early-winter lamb. If the lambs are weak when born if often indicates that the feed of the ewes has been deficient in some of the essential minerals, food elements or vitamins. Reinforcing the hay, if it is of poor quality, with cod liver oil and stock molasses often corrects this fault. The cod liver oil may be purchased at $19.50 per 30-gallon barrel and with the molasses diluted with hot water may be spread upon the hay with a spray pump.

W. H. LYTLE.
Salem, Oregon.

Sheep Practice in North Dakota

By T. O. BRANDENBURG,
Bismarck, North Dakota

THE number of sheep in North Dakota was estimated, in 1924, at only 253,846. By January, 1928, it was 450,000, and it reached the high mark of 1,100,000 in 1932. Due to the severe drouth, the number has been reduced to around 740,000, or less, at the present time.

Eastern North Dakota, from the beginning, has been almost exclusively a small-grain-raising section, comprising many large mechanized farms. Following the World War, declining grain prices forced many of these people to look for other sources of revenue, and as a result, bands of sheep ranging in number from 50 to 500 were placed on many of these farms.

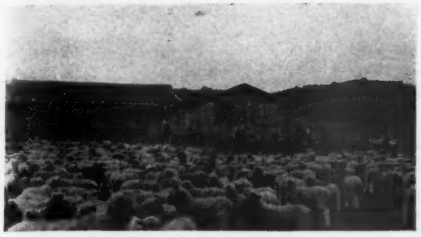
WHEN these bands of western sheep were first placed on our farms little trouble of any kind was experienced, other than occasional feeding trouble, such as bloat. As time went on, however, losses began to occur, particularly in the lamb crop, and owners were forced to seek expert aid. In cases where the local practicing veterinarian was of the right type he made himself useful to his clients. He used whatever knowledge he may have had of sheep ailments and did all possible to increase this knowledge and improve his service. To the North Dakota veterinarians, thus interested, this has proved to be a valuable addition to their practices, and, in a measure, has compensated them for the losses incurred in equine practice due to an ever-increasing use of all forms of automotive power.

In the beginning no attention was paid to the prevention of intestinal parasites. As a result more and more losses occurred among the lambs and more unthriftiness was noted.

Pregnancy Disease

The common stomach-worn infestation became general, and in sections where ponds of water or marshes existed, broad tapeworm infestation also became severe. On this account some farmers were compelled to discontinue sheep raising. Some of the veterinarians in the sheep counties have many calls during late summer and fall months due to the inroads of this parasite. Any remedy that removes the segments, even though some of the heads remain, seems to bring about an immediate improvement and stop deaths among the

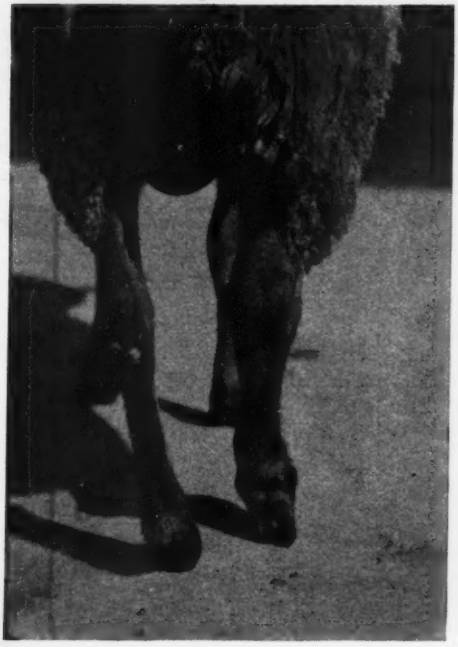
Founder and bloat causes heavy losses in sheep turned into grain fields to clean up after the combine.



lambs. All the taeniacides have been tried, including areca nut, kamala and cunic solution. Probably the latter has been the most satisfactory for the careful herdsman, who wished to treat his own sheep, providing he could be induced to treat them often enough. However, this is seldom possible, as farmers are busy harvesting and threshing their crops at the very time the sheep should be treated.

ALL this, together with losses from home treatments and improper administration, has given the veterinarian an opportunity to sell his services to the sheep man in the control of internal parasites of sheep. The veterinarians in our state who have built up and kept sheep practices have done so by furnishing a great deal of valuable, free advice to the sheep owner. For instance, when called to see sheep affected with pregnancy disease, a diagnosis is first made, and the cause of the disease and the best methods of handling the flock to prevent further losses is carefully outlined.

If sheep are dying with pneumonia, as is sometimes the case during the winter months, the veterinarian, after making a diagnosis by a necropsy, studies the environment carefully. The sheep sheds in nearly every case are too hot, too crowded, or too drafty.



Blackleg

Lip and Leg Ulceration

Sheep are occasionally poisoned by eating cyanogenic plants, such as cane, sorghum, corn or arrow grass damaged by frost or drouth. Death camas occurs in a few sections of the state and animals are lost from eating it.

The ailments of sheep in North Dakota in order of their importance are: broad tapeworm, stomach worm, pregnancy disease, bloat, pneumonia, sore mouth, grub, infectious keratitis, abortion, tetanus, urinary calculi, sweet clover disease, prussic acid poisoning, anthrax and blackleg.

Sheep Raising in California

A Band of California Sheep
They belong to an outfit grazing 10,000 head

By HUGH S. CAMERON, Davis, Calif.
University of California

SHEEP RAISING in California is one of the state's most important livestock industries. Sheep in this state number over 3,000,000, and the annual wool production is in excess of 23,000,000 pounds. The state probably ranks first in the production of spring lambs for eastern shipment in April and May.

Bands range in size of from 1000 to 3000 ewes, with an average of 1400. About 70% of the sheep is found in the Sacramento and San Joaquin valleys. The remainder are in the coastal and northern counties, with a few in the Imperial Valley, in the extreme southern portion of the state. It is in this latter section that the first spring lambs are produced, followed closely by the Sacramento and San Joaquin valleys. Mild winters with green feed and an abundance of spring feed for finishing are prerequisites for this branch of the industry.

The important breeds are the Rambouillet, Hampshire, Suffolk, Shropshire and Southdown. There are, of course, other breeds raised but those mentioned are most frequently encountered.

FEEDING practices naturally vary with the locality and even from year to year in any section. They are influenced chiefly by the rainfall. When available, good pasture of barley stubble is used, and irrigated Sudan grass is considered ideal. Many growers breed their ewes to lamb in the foothills or valleys in the spring when an abundance of feed is available, and move their flocks up to the mountains and national forest reserves about the middle of May.

After shipment of early fat lambs to market, a number of feeder lambs usually remain. In recent years ladino clover pastures have been developed in the irrigated valleys. This provides an excellent feed for fattening lambs; 40 to 60 days being required to fit them for market. Because of the heavy incidence of parasites in this type of pasture, it is available only for feeders.

WOOL production is, of course, an important source of income to the industry. Here again the altitude, climate and soil types produce variation. The wool may be placed in three groups as to quality; (1) that obtained from northern counties, (2) from middle counties and (3) from southern counties. Some of the finest wool in the United States is produced in the northern counties. Most of it is from sheep of merino extraction. Here the practice is to shear once a year, generally in May, whereas in the remainder of the state the practice is to clip in April and in August. This fact adds materially to the value of the wool. Northern wool is clean, free from vegetable matter, and light in shrink. Next in quality is the

middle counties. The spring clip has a growth of seven months and is usually fairly clean and free from seeds. The fall clip has a growth of five months, is usually short and seedy. The southern counties' wool is of the poorest quality. It has a greater shrinkage, and contains large quantities of vegetable matter. Naturally, the amount and quality of wool produced by an animal is related to its physical condition. Therefore, losses due to disease, should be computed both in carcass and in the wool.

Sheep Diseases

Sheep diseases in California are comparable on the whole to those reported from other western states. Probably the greatest problem is the control of parasitic diseases. This is intensified in irrigated sections and especially on ladino clover. These pastures are irrigated every ten days during the summer. Coupled with the warm climate this provides ideal conditions for the development of the larvae of *Trichostrongyles exei,* the most prevalent parasite of these areas. Cunic mixture is used in the treatment of this condition. Another stomach worm frequently encountered is the *Ostertagia circumcinata.*

The *Hemonchus contortus* or common stomach worm has, so far as is known, never been reported in sheep in California. Should animals infested with this parasite be introduced on ladino clover or other frequently irrigated pastures undoubtedly this parasite could establish itself easily.

Nodular worm disease has not, as far as is known, been encountered.

Liver flukes present a serious problem in certain areas where low wet pastures and the consequent presence of the intermediate host enables the parasite to flourish. The parasite has been eliminated from a few of these areas by draining the swampy ground or by the application of copper sulphate to the surface water. In treating sheep for liver flukes carbon tetrachloride in 1cc. doses administered in capsules is effective.

Lung worms are frequently encountered and are responsible for many cases of bronchitis and pneumonia. *Monieza expansa* occurs rather frequently but the losses from this parasite are apparently low.

The screw worm is found in the southern part of the state.

Among the non-parasitic diseases, lamb dysentery causes heavy losses in certain areas, especially where there has been considerable fog, rain and lack of sunshine. Moving the ewes to new grounds generally ends the outbreak.

Pregnancy disease is encountered where supplemental feeding is practiced and the ewes get only a limited amount of exercise. Autopsy of affected animals invariably reveals a fatty maternal liver, and in the majority of cases twin fetuses.

Caseous lymphadenitis is prevalent. Although the mortality is low, losses from unthriftiness are considerable.

Foot-rot, if not checked, causes severe losses. Drastic trimming of the feet and the application of suitable antiseptics is essential in this condition.

Poly-arthritis is a chronic disease that causes poor growth and loss of condition in lambs. There is evidence that this disease is due to a specific organism that gains access to castration or docking wounds. This should not be confused with white muscle disease, a disease of unknown origin causing stiffness in lambs two to eight weeks of age.

Para-tuberculosis enteritis of sheep, resembling Johne's disease in cattle, has been found in one area in California.

Poisonous Plants

St. John's Wort is one of the most important of the poisonous plants so far as sheep are concerned. It grows on sheep ranges in northern California, and when eaten produces a blistering of the unpigmented skin especially if the animal be exposed to direct sunlight.

Death camas abounds throughout the state in the open hill country and in the valleys.

Fit weed, found in northeastern California, causes much trouble.

These are but a few of the plants poisonous to sheep. In this brief discussion it is impossible to discuss all of them or all of the diseases encountered.

Sheep Breeding in Mexico

By DR. JOSE FIGUEROA, Mexico, D. F.
Chief of the Biotechnic Institute

Type of imported Rambouillet rams used in Mexico for crossing with native ewes

THE sheep in the Mexican United States in 1930 numbered 3,673,887, most of them descended from the Spanish breeds imported in the early years of the Conquest.

The sheep have undergone certain transformations owing to climate, soil, feeding, and handling conditions in the different regions of the country for over 300 years. It is true that there exists, in several regions, cross-breeds of the different short and long wool English races, and many others have been improved by the Spanish merinos or the French Rambouillets, but these forms the minority of the whole number of sheep.

NATIVE sheep are, generally, either white or black although there are some chocolate or ash colored, the latter probably from degradation of black, or as a result of the cross breeding of black with white sheep, or because of inheritance from some imported breed from Asia Minor or Africa since the time of the Conquest; hence the resemblance to the karakul sheep.

Other native sheep present the characteristics of the "Churra" breed, also predominating in Spain, which characterizes itself mainly for its long, open fleece without curls and with much kemp. The head is small, free from wool or lightly covered by a small toupet, long ears slightly droopping, the trunk cylindrical, having a fuller hind quarter than the front limbs, and long, slim and bare legs frequently spotted in black or chocolate color. They are good mothers, have good udders, and are prolific.

Sheep descended from the merinos have wholly lost many of their characteristics, for the wool has disappeared from the face, the wrinkles have gone from the neck and the wool is lacking from the hoofs up over the knees and hocks.

Many of them present the characteristics of the crossing of the merino and Churra breeds, having the wool a little looser and almost all of them deprived of staple or dirt. In the majority of cases the horns are twisted spiral like, rather than spread without transverse grooves, characteristic of the actual merinos. The ewes and lambs are always hornless, have lost the wool in the back of the front limbs, and in the medial side of the legs and underneath the belly; the skin being of a whitish or lightly pigmented color.

The tail is long, reaching below the hocks, and cylindrical in form. The hoofs are small, hard and frequently spotted or pigmented.

The height of these sheep is from 24 to 26 inches and the weight is from 50 to 65 pounds.

THE meat in lambs or mutton sheep is very greasy, but of excellent flavor; the taste being very agreeable. However, the light muscular development of the legs, ribs and loins makes the different cuts of mutton too lean; the fat being deposited in masses outside of the muscles.

The consumption of mutton in Mexico amounts to nearly 900,000 sheep a year, with a weight of 4,541 tons. The wool of

Mexican sheep has lost the fineness originally possessed by these breeds and a great part of its elasticity. The sheep are shorn twice a year, hence the fibre length is not more than 1½ inches and the yield per animal is only 1¾ to two pounds of wool per year.

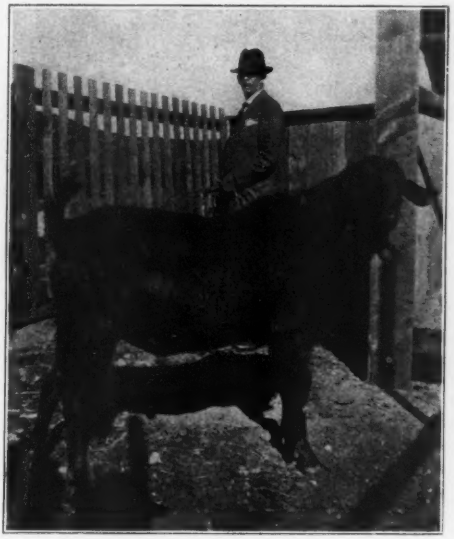
That is why the "Dirección de Ganadería" (Bureau of Animal Industry), some years ago began an intense campaign to popularize certain English breeds and the descendants of the better classes of merinos, aiming to obtain by cross-breeding, a more satisfactory product for the market requirements, that is, to obtain a sheep, of great size and producing a greater yield of wool.

To promote this movement for better sheep, several booklets entitled: "Las-principales razas de borregos" (The principal breeds of sheep), "Campaña en favor del mejoramiento en calidad y cantidad de lanas" (A campaign towards the improvement in quality and quantity of wools), and others have been published. The Department has distributed them profusely throughout the Republic, especially in the sheep breeding regions, so that the Mexican breeders are cognizant now of the advantages of rebuilding the native herds.

Owing to this campaign the breeders are grading up their herds and there is a good demand for pure-bred rams of the Rambouillet, Hampshire, and Lincoln breeds.

IN THE fall of 1934 the Secretary of Agriculture imported nearly a thousand Rambouillet rams from the Rocky Mountain states to distribute among the breeders all over the country. Since then the breeders themselves have imported more than 21,000 head. Most of them, pure-bred Rambouillets from Texas.

THE National School of Agriculture of Chapingo, Edo de Mexico, is carrying on some experiments in crossing the pure-bred karakul sheep with native ewes. During the past several months the Government has donated many good rams to the native tribes of Indians to improve their herds and get a better fleece to make the famous blankets called "serapes, jorongos, and frazadas." "Sarapes" are blankets about 3x6 feet woven in many brilliant color arrangements, and used as a coat. "Jorongos" are smaller than sarapes and have a hole in the center to put the



head through; allowing the jorongos to drape over the shoulders. They are worn mostly on the range. "Frazadas" are large blankets and used as bedspreads.

THE Government is making an effort to improve, in all ways, the native sheep because there is a shortage of wool. Nearly a thousand tons are imported yearly. which should not be, as there are great grazing areas in many of the states which have only a few sheep.

There is a splendid market in Mexico for surplus American rams of good breeding. They are needed to improve the native herds and it would be more profitable to American breeders to so dispose of them than to send them to slaughter. There is also a wonderful opportunity for sheep raisers to settle in Mexico.

EDITOR'S NOTE.—We are indebted to Dr. J. Gilbert Horning, Houston, Texas, for his kindness in supplying this article for us. Doctor Horning has been spending some time in Mexico City on a vacation and while there prevailed upon Doctor Figueroa to write this informative discussion on sheep husbandry in Mexico.

Laboratory Consultation in Sheep Diseases

By S. J. SCHILLING,
Kansas City, Missouri

EVERY practitioner will encounter some conditions on which he may desire consultation. In some cases, a fellow practitioner may be called in consultation and between the two, the trouble may be diagnosed. In other cases, consultation with a veterinarian in the laboratory is preferable since the microscope, culture plate and test tube can then be called upon to yield additional evidence.

Speaking from an experience of 15 years in laboratory work, I would say that a laboratory consultation is far more valuable than a laboratory diagnosis. The consultation is more likely to shed useful light on the disease and to lead to the proper selection of a remedy. This is because it combines an evaluation of history, symptoms, and field autopsy findings with such facts as can be determined in the laboratory.

It follows, of course, if the laboratory veterinarian is to serve as a consultant, that he should be supplied with all the clinical information available. Further, judicious selection of specimens is necessary. Finally, the specimens must be so packed and handled as to arrive at the laboratory in usable condition. These in a nutshell are the requirements which bring the advantages of laboratory service to the practitioner.

Give History of Case

Veterinarians rarely undertake diagnosis in the field without first obtaining a good history of the case. This often avoids errors of diagnosis. The laboratory veterinarian likewise should be guided by the field observations supplied with the shipment of specimens.

How does it work out? A recent shipment of lamb specimens came from a band of 1,100 which were on a scant, drought pasture. There was a history of numerous losses, the animals showing eye and nose discharges, scouring and some straining, and being in general thin. These specimens presented rather extensive bronchopneumonia; cultures from the lungs, kidneys and spleen yielded streptococci and staphylococci. This was evidence that infection possibly originating from the respiratory channels of the head, was extending throughout the system and suggested the use of an alkalizing treatment and a mixed bacterin. Careful search of the small intestine revealed numerous rounded greyish areas of the size of a pin head in the mucous membrane. Microscopically these spots were found to contain myriads of coccidia; treatment with suitable astringent medication per os and improvement of the ration seemed indicated. It was concluded that poor nutrition and parasitic disturbance were the primary etiologic factors leading to reduced resistance and that the generalized infection was a secondary factor. Treatment instituted was gratifying to both the attending veterinarian and his client.

It is obvious that it required a rather complete study of all available data to select appropriate treatment for this band of sheep. Another case comes to mind which illustrates the desirability of supplying the laboratory consultant with the history and post-mortem findings. Specimens were received from a band of sheep where ewes were dying. The specimens were decomposed beyond serviceability. Symptoms however, were described and these included grinding of teeth and pushing against objects; also excitement, holding the head high and spasms were mentioned. In addition it was mentioned that the outstanding post-mortem findings were acute fatty degeneration of the liver and that the ewe was carrying twin lambs. These data permitted a secure diagnosis of stercoremia, toxemia of pregnancy or "lambing disease."

The field veterinarian should not omit stating what malady he suspects to be

present. Numerous instances could be cited to illustrate how this aids the laboratory veterinarian. Special procedures can then be applied which more certainly confirm or eliminate the provisional diagnosis.

Selection of Specimens

Suppose a good statement of history and symptoms is given. How about the selection of specimens? In many cases this involves no difficulty. A weed may be suspected of causing poisoning; often this requires root, stem, basal leaves, top leaves, and flower or fruit. Parasites may be suspected; a fecal sample will show some varieties but will be almost sure to miss tapeworms, flukes, and ordinary lung worm infestation; autopsy and specimens from within often are required. Sheep scab is readily diagnosed in the laboratory but scrapings must be taken deep enough to get down where the parasites live. If mineral deficiency is suspected, a few vertebrae, a long bone from a leg, and a rib or two are desirable.

Selection of specimens frequently is made at autopsy. Portions of all pathologic tissues found can be gathered and give a rather complete sampling of the morbid processes involved. The autopsy of course should be thorough; where a large flock is involved post-mortem examination of several animals always is desirable since no one individual may present the disturbance causing losses in the flock as a whole.

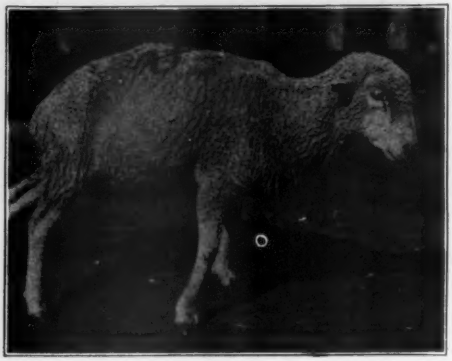
Autopsies should be made on the fresh cadaver. Necropsy of an animal which already is partly decomposed, usually is of little value. It is far better to sacrifice an animal or two in advanced stages of the disease or wait for one to develop. Especially is this true in warm weather since the post-mortem changes may cover up or destroy pathologic changes characteristic of the disease and thus prevent recognition of the malady. Moreover, tissues partly decomposed when collected are very likely to be worthless by the time they reach the laboratory. Naturally, at death of the animal there is rapid multiplication of saprophytic organisms in the cadaver; then pathogenic organisms, if present, usually no longer find suitable environment and cease to develop. Thus the saprophytes become proportionately so numerous as to prevent isolation and identification of the pathogens. The delayed post-mortem examination may even prevent the determination for example whether a primary enteritis or a primary pneumonia is present. That in itself beclouds the problem. But in many cases one can select sections readily of pneumonic lung, or inflammatory spleen, liver, kidney, intestine, lymph node or muscle tissue and thus get a representative cross section. In general, pieces of the size of the palm of the hand are desirable. In the laboratory these may be seared on the surface and cultures obtained from within. In other types of examination they are large enough as a rule to select the most significant part.

Just a word about blood samples in diagnosing sheep diseases. They are just the thing for diagnosing *Brucella melitensis* infection which sometimes occurs in sheep and they usually are adequate to diagnose anthrax is taken after death of the animal. But otherwise the safe rule is—don't send them. Even in the case of hemorrhagic septicemia, it has been my experience that the animal frequently dies before there is

widespread distribution of the organisms in the blood stream; cultures from bronchial tubes, spleen or other invaded tissues of the same animal may yield the organisms in abundance.

Packing and Shipping

Packing and shipping the specimens are next in order. Like in most things there is a right way and a wrong way. The right way will get the specimens through to the



Icterohematuria

laboratory in good shape; the wrong way may defeat the purpose in collecting and sending them. The right way starts with providing a clean pan, bucket or newspapers before opening the animal. The specimens should be kept clean as possible. Bowel sections should be tied off at both ends; these and the stomach always should be kept separate from other tissues. Next, two methods of handling may be used. The specimens may be placed in a clean container like a syrup bucket with a tight lid; again stomach and intestines with their high normal bacterial content should be kept separate. The syrup bucket can then be packed in a light box or fairly tight crate with sawdust, bran, chops or cotton seed and cracked ice. It is best if the outer box is not too tight; thus the water is free to drain away. Instead of cracked ice and the suggested packing one may use dry ice and newspapers. Dry ice can be obtained in many communities. It reduces transportation charges and is easy to handle.

Another means of packing, if it is impossible to ice the specimens, is to place them in a jar, can or fibre board box with a layer of a half inch of boric acid or sodium bicarbonate in the bottom of the

Infectious Pneumonia

container and a similar layer between the various specimens separating them from each other. Such packing discolors and dries the specimens badly. It often prevents recognition of hemorrhages into the tissues, edema and congestion and makes it all the more important that description of autopsy findings be given. But it does preserve the tissues to a commendable degree and if refrigeration is out of question, is a method that may well be employed.

Specimens on which bacteriologic culture is not required may be packed in 10% formalin. Usefulness of this method is mostly restricted to material like tumor tissue and intestinal parasites.

The veterinarian in the field and the veterinarian in the laboratory are in a partnership when a diagnosis is involved. Each should supply the other with all the information he can gather. It is only by putting clinical observations and diagnosis together with laboratory findings and diagnosis that a high degree of accuracy can be obtained. All indications apparently lead to the fair assumption that this method of cooperation will be followed increasingly in the future and that it will be a valuable aid to the practicing veterinarian in giving service to his clients.

Home Ranch with 14,000 sheep. Snake River Valley, Idaho

Western Sour Dough Bread

An old sheep man, running about 18,000 sheep in the Idaho mountains gave us the following directions for "sour dough" bread and hot cakes:

"First thing you got to make a starter, which I does like this:

½ cake compressed yeast
2 tablespoonfuls sugar
2 teaspoonfuls salt
2 cups flour
Add cold water and mix to a paste that will pour.
Set in a crock in a warm place to raise.

"To make a batch of bread or biskits, you take enough starter and add flour, a pinch of salt and two tablespoonfuls sugar. Knead this well, and mold into small loaves or little thick biskits, and let raise in a warm place for about 20 minutes. Then bake about half an hour or until done.

"For hot cakes, take a dab of starter in a young crock or bowl, stir in a little corn meal, add a pinch of salt and soda, and a shot of sugar. We never measure anything —we just go by guess and by God.

"When the batter is just thick enough, grease a skillet with ham or bacon fryings, and pour on enough to make a full sized hot cake. It will be light and fluffy and a golden brown.

"I've seen city wimmen that spent all their spare time detailin' their symptoms spend a few days up in the mountains, an' when they come in for breakfast you otta see 'em reach for grub. Fust, they would eat half a can of peaches with canned milk on 'em. Next, they would grab a stack of sour dough hot cakes, two fried eggs, a hunk of ham or some bacon, with a side dish of fried spuds, half a pint of maple sirup and three sheep herder cups of coffee."

Dr. E. T. Baker at his favorite hobby

Mt. Rainier from Natchez Pass

Control of Some Sheep Parasites

J. H. RIETZ, Morgantown, West Virginia

The Author

SPECIFIC research in connection with methods of control and treatment for sheep parasites received comparatively little attention until recent years. Some information was given to the world 45 to 50 years ago, but most of it was the result of field observation and lacked adequately controlled investigational background.

Research leading to better control methods has been conducted by a few investigators during more recent years, and with the development of better control methods, there is presented the problem of education of the sheep husbandmen. This phase of the work should be performed by the veterinary profession. The practitioner should show more interest and activity in this educational program than he has shown in the past.

Many practitioners and sheep husbandmen think of parasites in terms of the stomach worm. However, we have found 16 species of parasites in post-mortem examinations of sheep used in research work.

Diagnosis

Diagnosis of parasitism in a flock of sheep may be made from clinical observation, the demonstration of ova in the feces, or necropsy of a dead or a moribund sheep destroyed for the purpose.

An autopsy including the demonstration of parasites is often the only argument necessary to convince the owner of necessity of control measures.

Methods of Control

A good deal has been said in the past concerning pasture rotation as a means of parasite control. More recently, research has concerned itself with temporary pastures for the same purpose. (See North Carolina Experiment Station Bulletin No. 271 by Hostetler and Foster).

Treatment

Many chemicals, drugs and combinations of drugs have been used in the treatment of sheep for gastro-intestinal parasites. Critical tests of a number of preparations indicate that satisfactory control is obtained by systematic treatment with either 1½% copper sulphate solution or a mixture of equal parts of 1½% copper sulphate solution and 1½% nicotine sulphate solution. (See West Virginia Experiment Station, bulletin No. 264.)

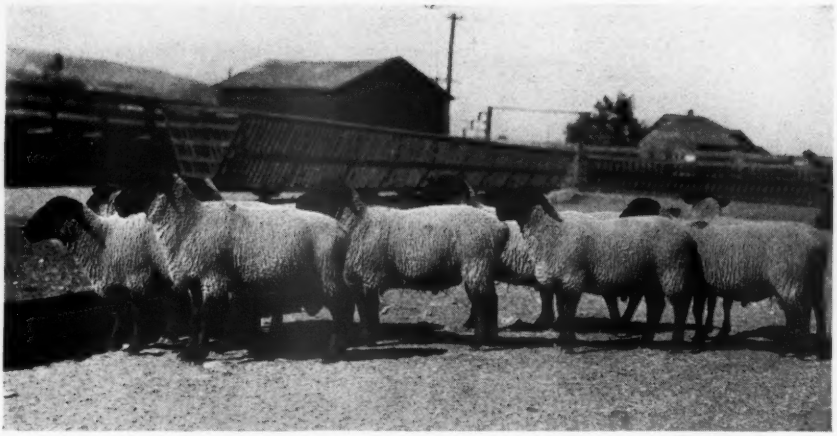
The dosage of either the copper sulphate solution or the mixture of equal parts of the copper sulphate and nicotine sulphate solutions is:

Adults	3 oz.
Yearlings	2½ to 3 oz.
Six months of age	1½ to 2 oz.
Three months of age	1 to 1½ oz.

The treatments should be repeated regularly at intervals of not more than 21 days.

The sheep should be starved for 24 hours before treatment, excepting the ewe flocks which should be treated without starving during the lambing period and for two treating periods following lambing. Starving before treatment increases the efficiency of the drench approximately 20%.

Critical tests have shown that treating heavily parasitized sheep, at intervals of 21 days, has lowered average level of the ova count in the feces as much as 98%. Tapeworm segments and ova also disap-



Courtesy, B. A. I.

Crossbreds for Market Lamb Production
From Suffolk rams and Rambouillet and Corriedale ewes. U. S. Sheep Exp. Station, Dubois, Idaho

peared from the feces to an equal degree under either treatment.

Starving

Starving the sheep before treatment, in some manner affects the passage of the solution to the abomasum and intestines where it contacts the parasites. Equal numbers of sheep prepared by starving and not starving, were drenched with a dye solution. Immediate autopsies revealed that the dye solution passed to the abomasum more regularly in the starved group than in the unstarved group.

Lung Worms

The control of lung worms in sheep is progressively becoming more important over a greater area of the sheep producing territory. The routine method has been anesthesia with chloroform. This has given fair results but is not unattended with danger of losses from pneumonia.

An oily extract of pyrethrum injected into the trachea has also given good results, without, or with very little danger of pneumonia complications. Care must be exercised in the intratracheal injection; since small amounts escaping into the wall of the trachea or into the surrounding tissues results in great swelling and possibly death of the sheep.

A pyrethrum solution extracted at the concentration of three pounds of pyrethrum flowers to one gallon of oil is efficient, if given intratracheally, in 3cc doses for an adult sheep. Approximately 70% of the animals will require but one treatment. From 3 to 5% will require up to three treatments to eliminate the parasite.

Feeding

In any parasite control program, proper feeding is essential. Drenching sheep with drugs will not compensate for poor feeding, nor will good feeding practices compensate for the treatments. Maximum benefit is obtained only by systematic treatment and good feeding practices.

Mass Feeding

Mass feeding of a mixture of copper sulphate and salt is practiced in some sections of the country to control parasites.

Critical tests, at West Virginia Experiment Station (see Bulleton No. 271), indicate that mass feeding of sheep on a mixture of pulverized copper sulphate and salt, 1 to 30, fails to keep infestation down to a constant low level. The feeding of this mixture caused death from copper sulphate poisoning before the end of the first year's feeding period.

A one to 50 mixture of the copper sulphate and salt was wholly inadequate in the control of gastro-intestinal parasites. The mixture was kept in boxes accessible to the sheep at all times and was their only source of salt.

Angora Kids "Staked" Out

Diseases of Range Angora Goats

By I. B. BOUGHTON, Sonora, Texas

THE Angora goat industry in West Texas is, distinctly, big business. Approximately 2,820,000 Angora goats produce an annual mohair clip of 13,000,000 pounds, or 75% of all the mohair produced in the United States.

The goat raising region is rough, sometimes mountainous, cut by deep canyons and draws, thickly dotted with brush and trees, such as live oak, shinnery oak, cedar, mesquite, etc. The ground vegetation runs largely to turf grasses, as curly mesquite and buffalo, with a generous supply of weeds. The ranches vary in size from a section carrying two or three hundred goats to larger outfits running several thousand head.

The billy goats are turned in with the nannies in the fall for about six weeks, and the kidding season starts along toward the middle of March. On many ranches the kids from registered herds are dropped in the headquarters pens.

Goats are sheared twice a year, usually in March just before the kidding season, and again in September or early October. The goats are usually free in the range pastures, except for the kidding season and the shearing periods, or, for some special reason, such as drenching for stomach worms, treatment for screw worms, etc.

Common Diseases

Among the non-specific conditions which cause trouble among range goats, chilling from exposure to inclement weather is the most important. Many cases of chronic progressive pneumonia subsequently develop.

Digestive disturbances are not common, as the goat is a sensible animal, and keeps his appetite within reasonable bounds.

Infectious Diseases

Contagious ecthyma (sore mouth) is the commonest and most important of the specific diseases. This virus-borne infection usually appears during the spring and summer months and attacks the kids principally, although older susceptible goats may contract it. Shortly after the characteristic vesicles appear on the lips, these inflamed structures swell and become covered with a brownish-pink crusty scab which interferes with suckling and largely prevents grazing or browsing. The kid loses weight and condition at a critical period of its life, becoming permanently stunted. The disease is self limited, and, in uncomplicated cases heals spontaneously within 21 to 30 days. The necrophorous organism does not complicate the disease in this region, but the common screw worm causes tremendous losses. Medicinal treatment has not proved satisfactory, to say the least. We have found an oily mixture consisting of two parts lubricating oil and one part pine tar oil, applied daily to

the infected lips keeps the scabs soft and flexible, thereby reducing cracking and bleeding, and reducing the screw-worm menace.

Vaccinating the kids at marking time, or even later, with contagious ecthyma vac-

Contagious Ecthyma (Soremouth)

cine, prevents the disease. This operation, which consists of rubbing a drop of vaccine into a small scarification one-quarter inch long in the hairless skin, preferably on the under side of the tail, confers a lasting immunity.

Infectious keratitis (pink eye) is of fairly common occurrence. It is important in this region due to the purulent discharge attracting the screw-worm fly. Isolation of infected goats and individual treatment with yellow oxide of mercury ointment seems to be the best line of treatment. We have not had much success in prevention or treatment by the injection of keratitis bacterin.

Occasional outbreaks of anthrax occur, but they are few and far between.

Hemorrhagic septicemia is conspicuous by its absence among range flocks.

Tetanus is seen in the spring or fall, several weeks after shearing.

Gas gangrene (malignant edema, etc.), occurs only occasionally.

It may be interesting to note we have not encountered any cases suggestive of takosis among the goats of this region.

Parasites

Stomach worms and trichostrongyles are the two parasitic troubles which are prevalent and must be controlled by medicinal treatment and pasture rotation.

Lung worm and nodular worm infestations occur over a large part of the region, but have not yet reached economic proportions.

A 0.75 to 1% copper sulphate and an 0.8% nicotine sulphate solution in two-ounce doses for kids and four-ounce doses for yearlings and older goats is the standard drench employed for both haemonchiasis and trichostrongylosis. Many ranchmen prefer tetrachlorethylene capsules to the drench mixture. Either is effective when properly used. The common practice in this region is to start treating in the later afternoon or evening, and then turn the animals out to pasture at daybreak the next morning.

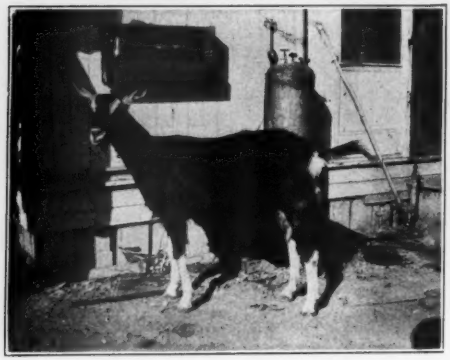
Biting lice infest many of the range flocks. Recent experimental and field dipping trials, made by the federal entomologist attached to this Station, using a dip composed of 10 pounds elemental sulphur and 100 gallons of water, rid the goats of lice after two dippings, 11 days apart.

Goat scabies, caused by the *Chorioptes capres*, occurs occasionally. It is not communicable to sheep. Treatment consists in dipping in the standard lime-and-sulphur solution. Two dippings at 11-day intervals usually suffice to clear up the condition.

The screw worm is by far the most important external parasite of the goat in this

Advanced Case of Scabies

region. No efficient means of preventing its infestation is yet known. The best means of treatment at the present time is to kill the larvae by flooding the wound



with benzol, and remove them and apply some repellent. Bone oil (made from the destructive distillation of animal bone) is a good repellent.

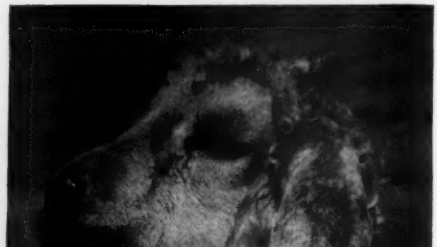
Poisonous Plants

While there are a good many different weeds and brush poisonous to goats, losses are confined, for all practical purposes, to the following five plants:

Lechuguilla is a tough, fibrous Yucca. The active toxins are not definitely known, but Mathews of the Texas station has shown that they contain a photo-sensitizing agent and poisonous saponin. There is no successful medicinal treatment. If found when the condition is just starting, many of the animals will recover if removed to shelter from the direct rays of the sun.

"Swell head" occurs among goats and sheep in the region where sacahuiste grass is abundant. This is a coarse bunch grass which is a fair forage plant except when the buds are sprouting in the spring. Medicinal treatment is of no avail. Placing the animals in the shade and putting them on feed offers the only hope of recovery.

Coyotillo is a shrub growing from 3 to 20 feet in height and is found more or less abundant in the southern part of the goat raising region. The leaves are slightly toxic, but most cases of coyotillo poisoning in goats result from consumption of the



Swellhead

fruit, a small berry. Protracted paralysis, especially of the posterior limbs, is the characteristic symptom. The animal retains its appetite, and apparently suffers no pain. It usually succumbs weeks or months after the symptoms are first manifested.

Shin or shinnery oak and live oak are the other poisonous plants of this region.

Sheep Husbandry in Wisconsin

WALTER WISNICKY, Madison, Wisconsin

The Author

SHEEP raising, in most cases, is regarded as a side-issue in our state. We have a considerable number of pure-bred flocks in the state, although for the most part our sheep consist of relatively small farm flocks maintained, for wool and meat production, on dairy farms which, to some extent, practice diversification.

Our state, although not regarded as a center for feeding western lambs, nevertheless does import annually several hundred thousand western lambs for feeding purposes. From 250,000 to 450,000 fat lambs and sheep are marketed annually. Native lambs do not do well in the feed lot on account of the heavy infestation with internal parasites. The feeding period starts in September and is carried through the fall and winter months. An attempt has been made to feed early lambs from the south during the spring and early summer months. Invariably this has been a disappointment on account of the delicacy of such lambs and difficulty with coccidian infestation.

OF THE various infectious diseases, hemorrhagic septicemia is perhaps the most important. For some years our livestock have been practically free from blackleg and anthrax. In only rare cases is lip and leg ulceration reported.

Stomach worms, tape worms and nodular disease are the most troublesome of the parasites. Sheep ticks and grub in the head are comparatively common. We have had no scabies in our state for more than two years.

The spring of the year, during and prior to lambing, is perhaps the time when the veterinary practitioner receives the most sheep calls. The conditions which need attention at this time are preparturient paralysis and dystocias. The veterinarian is likewise frequently consulted when farmers kill sheep for their own use. They observe the lesions of nodular disease and become alarmed about the condition. There are an increasing number of farmers who consult their veterinarian concerning treatment for stomach and tapeworms. Calls are also received when young lambs develop a persistent diarrhea, subsequent to being turned on luscious, legume pasture. Acidophilus milk is good for dysentery given as recommended by Shaw of Oregon, in ounce doses several times a week.

THE dog problem occupies the attention of sheep owners more than any other condition. During the year 1935, 13,266 sheep were killed by dogs and predatory animals, and the state paid claims for sheep killed by dogs amounting to $55,528.24 during that year. This does not include the large number that were injured but recovered.

The Preparation of Ovine Biologics

By H. J. SHORE, Fort Dodge, Iowa

THERE are prepared for the treatment and prevention of hemorrhagic septicemia both aggressin and bacterins. For these products not only are the strains of pasteurella isolated from various species of animals employed, but also pasteurella cultures furnished by the federal Bureau of Animal Industry, and commonly known as the "buffalo strain" are used. In the cases of aggressin, healthy animals are inoculated with the cultures. These animals are usually dead within 18 to 24 hours. The sero-gelatinous exudate found in the subcutaneous tissues, and in certain other areas in the carcass of these animals is collected. The juice is expressed and filtered through bacteria-retaining filters, tested for sterility and potency, and if found satisfactory, is marketed.

In the case of bacterial vaccines (bacterins) for hemorrhagic septicemia, essentially the same cultures are used. These cultures are grown on solid media best adapted to the cultures involved. When the maximum amount of growth has been secured, the cultures are removed from the incubator and the growth carefully harvested. The bacterial suspension is standardized and made innocuous. However, the antigenic value of the cultures is not altered. The standardized bacterial suspension of the various cultures is then tested for sterility and potency, filled into final containers and marketed.

In the case of mixed bacterin for sheep, this product is prepared in practically the same manner that is used in preparing hemorrhagic septicemia bacterin. The cultures employed are pasteurella obtained solely from sheep, *B. paratyphoid b, Streptococcus pyogenes, B. coli,* and *Staphylococcus albus* and *aureus,* all obtained from sheep. These cultures are secured from sheep affected with the condition commonly referred to as "shipping fever," and the conditions often found in sheep held in feeding pens. The important steps in their preparation are practically the same as in the manufacture of hemorrhagic septicemia bacterin and need not be repeated.

One of the more recent biologic products for sheep is the vaccine used for immunization of sheep (and goats) against contagious ecthyma—sore-mouth. A great deal of work done by Boughton in Texas has demonstrated that the vaccine is efficient.

The product is prepared from the scab formations of lambs inoculated with material containing the filterable virus of contagious ecthyma. The inoculated animals are specially prepared by cleaning the outer surface of the body and after inoculation are held in specially constructed crates away from all possible contamination. When the inoculated lambs show good lesions of the disease the scabs are harvested in an aseptic manner, carefully dried and ground. For marketing the pulverized vaccine is mixed with the proper volume of a sterile attenuating diluent.

Animals are vaccinated by making a slight abrasion on the skin and rubbing in a small amount of the vaccine. As is well known, among those handling sheep in areas where contagious ecthyma exists, the disease at times affects man. It is most commonly found in those areas where the screw-worm fly (*Cochliomyia americana*) is found.

Sheep also are treated with anthrax bacterin, rabies vaccine and occasionally with tetanus antitoxin.

The demand for autogenous bacterins for sheep and other domestic animals is increasing. In the preparation of an autogenous bacterin it is, of course, essential that the laboratory be furnished with material containing the causal agent of the disease existing in the band of sheep on which the bacterin is to be used. When this material has been furnished it is carefully plated and a thorough bacteriological examination made. If suitable cultures are secured from the material a bacterin is prepared from them, using essentially the

On Winter Feeding Grounds

same methods employed in the preparation of, for example, hemorrhagic septicemia bacterin, described in the foregoing. We find that veterinarians call for autogenous bacterins most often for treatment of sheep and lambs in feeding lots.

Autopsy for Stomach Worm Examination

Pick out a sheep that has small chance of living much longer, lay on its left side, cut the throat, bend back the head until the vertebrae snap, and in a few minutes make a V-shaped incision in the abdomen, and take out the fourth stomach with a few inches of the duodenum attached.

Have at hand an empty ten-quart bucket, over which has been placed some gauze. Lay the stomach and contents on this, make a slit through it, and empty the contents out on the gauze.

Pour cold water carefully over the stomach contents until all has been washed through the gauze into the bucket. A careful examination will reveal the presence of small, reddish, brown hair like worms in the gauze. A small magnifying glass is useful to show the owner the wriggling parasites.

This will demonstrate to him in a graphic manner the presence of stomach worms, and he will take more interest in the treatment, and follow directions more carefully.

Movements of the Rumen in Sheep

The movements of the rumen [72] and of the abomasum of sheep are phases of a series of contractions which consist of one main contraction and two supplementary contractions. They follow a rhythmical course. The movements of the abomasum exhibit lesser changes in pressure, in addition to fluctuation in tonicity. Their occurrence must be attributed to influences from the respiration and the peristalsis. The act of rumination and the movements of the rumen and of the abomasum are distinctly correlated temporally in so far as the regurgitation occurs always at a very definite moment. During rumination as well as after feeding there is a distinct increase in frequency of the movements of the rumen and of the abomasum, and in the latter organ also an increase in amplitude. Since the movements of the rumen and of the abomasum exhibit a distinct reciprocal correlation, it is safe to conclude that there must exist a central connection.

[72] Krzywanek, F. W., and Quest, P. 1936. Die Bewegungen des Pansens und Labmagens beim Schaf und ihre Beziehungen zueinander und zum wiederkauen. *Pflüger's Arch.* 238: 333-340.

Courtesy, B. A. I.

Rambouillet Ewes, United States Sheep Experiment Station, Dubois, Idaho

Laboratory Aid in Disease Control

DISEASE control among sheep presents a problem fundamentally identical in principle to the control of disease in other species. The successful control of any disease in man or beast is dependent primarily upon:

1. Correct diagnosis.
2. Removal of the cause or its means of transmission.
3. The building of resistance to the disease by natural or artificial means.

THE laboratory functions as an indispensable aid in arriving at a definite diagnosis. Likewise, our commercial biological laboratories provide means, in the form of vaccines or anti-sera, with which to induce resistance to many diseases.

The clinical history, symptomatology and gross pathology are of the utmost imtance, but in the absence of specific laboratory findings, serious error has been made frequently, in the attack upon some of the more important transmissible diseases.

THE very nature of the sheep raising industry, wherein the animals are mainly concentrated in large grazing areas, where adequate veterinary service is not available, and the general lack of familiarity with sheep diseases on the part of some practitioners, emphasize the necessity for laboratory assistance.

While hints for procuring, preparing and forwarding specimens have been given elsewhere, we might add these suggestions: In general, avoid forwarding large tissue specimens or whole carcasses to the laboratory, unless they can be delivered direct, or well packed in ice.

Small tissue specimens well covered and packed in borax generally arrive in satisfactory condition. Avoid addition of all preservatives, except where a tissue may be submitted for gross pathological examination only. In such instances, cover the tissue with a 1% formalin solution. Ship by the most direct method only, and at the same time forward a letter of information to avoid delay.

B. M. LYON.

Pearl River, N. Y.

Sheep Practice in Utah

Due to the fact there are very few farm flocks of sheep in Utah, the problem of disease control and sheep management is handled largely by veterinarians employed by the state or federal governments.

Generally, our sheep are grazed in the mountains during the summer, and on the desert lands in winter time, stopping only for a short period in the spring at convenient places for lambing and shearing. Ordinarily these sheep are maintained a considerable distance from any town and consequently, private veterinary practitioners are very seldom called to assist the herdsmen in their care. Usually when disease develops, or any other condition obtains which results in losses, assistance is sought from state or federal agencies.

There are, however, a number of ordinary sheep ailments that must be handled by the herders or attendants. One of these is "big head," from which large numbers are lost, particularly in the spring when they are being trailed from the winter deserts to the shearing corrals. This disease, we have learned, is caused by sheep being forced to graze on either of two plants that they would otherwise avoid, namely, coal oil brush and spineless horse brush.

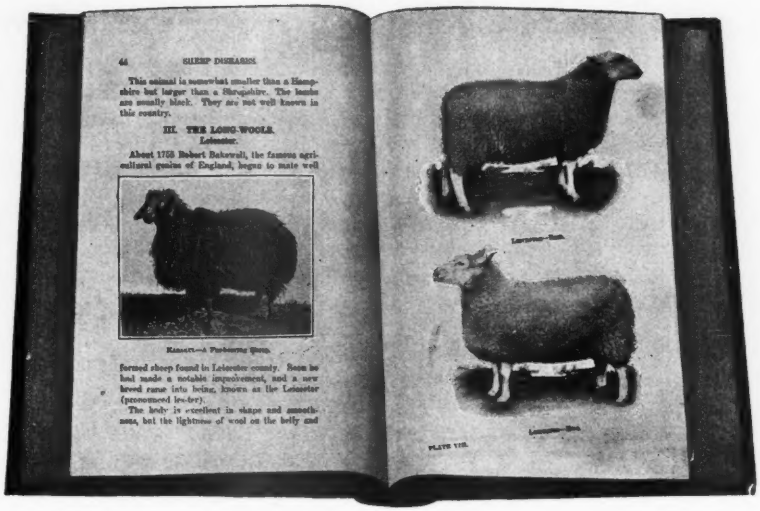
Another disease which causes considerable concern is mammitis.

Parasitism also causes much damage. Liver flukes are not so prevalent in range bands, but in flocks that are permitted to spend part of their time adjacent to ranches, particularly where the area is swampy, flukes occasion heavy losses. At the present time a project, with federal aid, is being carried out to control liver fluke through proper drainage and the treating with copper sulphate the snail-infested streams. These measures are proving beneficial when properly carried out.

Another problem is the sore mouth and venereal infection that occurs at certain times of the year.

W. H. HENDRICKS.

Salt Lake City, Utah.


44 SHEEP DISEASES.
This animal is somewhat smaller than a Hampshire but larger than a Shropshire. The lambs are usually black. They are not well known in this country.
III. THE LONG-WOOLS.
Leicester.
About 1758 Robert Bakewell, the famous agricultural genius of England, began to make well
formed sheep found in Leicester county. Soon he had made a notable improvement, and a new breed came into being, known as the Leicester (pronounced les-ter).
The body is excellent in shape and smoothness, but the lightness of wool on the belly and
PLATE VIII.

Reference Works on Sheep and Their Diseases

The following books and bulletins have been found useful in our everyday practice:

Special Pathology and Therapeutics of the Diseases of Domestic Animals by Hutyra and Marek.

Veterinary Anatomy, by Sisson.

Veterinary Pathology, by Kinsley.

Feeds and Feeding, 20th Edition, by Henry & Morrison.

Manual of Poisonous Plants, by Pammel.

Sheep Diseases, by Baker.

Journal Articles

Baker, E. T. 1932. Some sheep diseases I have met. *Vet. Med.* 27:398-401.

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Cross, F., and Newsom, I. E. 1931. A survey of icterohematuria in sheep in Colorado. *Vet. Med.* 26:75-77.

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Gilman, H. 1934. Vibrionic abortion of sheep. *Cornell Vet.* 24:207-209.

Magens, H. J. 1934. Pulmonary strongylosis of the small ruminants. *Vet. Med.* 29:316-319.

Mills, R. H. 1932. Lambing paralysis. *Vet. Med.* 27:186-187.

Newsom, I. E., and Cross, F. 1931. Coccidial dysentery in Colorado feeder lambs in 1930. *Vet. Med.* 26:140-142.

Newsom, I. E., and Cross, F. 1933. Blackleg in sheep due to shearing. *Vet. Med.* 28:16-20.

Rietz, J. H. 1937. Control of parasites in sheep. *Jour. Amer. Vet. Med. Assoc.* 43:163-168.

Rosenwald, A. S. 1936. Sheep scabies and Navajo Indians. *Vet. Med.* 31:163-170.

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Wright, W. H. 1935. Prevention and treatment of parasites of large domestic animals. *Vet. Med.* 30:307-311.

Bulletins

"Sheep and Their Care," Circular No. 39, North Dakota Experiment Station, Fargo.

"Studies in Foot-rot," Bulletin 285, Montana Experiment Station, Boseman.

"Milk Goats," Farmer's Bulletin No. 920, U. S. Department of Agriculture, Washington, D. C.

"Poisonous Plants of Pennsylvania," Pennsylvania Department of Agriculture, Harrisburg.

"Stock Poisonous Plants of California," Bulletin 593, California Experiment Station, Berkeley.

"Poisonous Plants of Alabama," Alabama Agricultural Experiment Station.

Range Sheep Management

By H. B. SOULEN, Weiser, Idaho
Practical Wool Grower

THE ewes in this part of the West generally are of the cross-bred type—quarter-bred and half-bred. They are large, often weighing more than 130 pounds when fat. They are mostly white-faces, and are by bucks of either the Panama, Romney or corriedale breeds.

January first will find the ewe bands in the feed yard. The bands in the fall are made on the average of about 2,000 head. The owner of such a band will have provided himself with 600 tons of alfalfa hay, which may be enough if grass is not too late coming in the spring. Two men with a good team of horses and a 16-foot rack scatter three big loads of this hay each day for the sheep. He tries to find a feed yard with running water, and as close to the hay as possible. Some operators feed grain before lambing, depending on the condition of the ewes, price of grain, etc.

IF THE bucks are put with the ewes September 5th, one must be prepared to take care of the lambs, which will start to drop about, February first. As a rule, the bucks are left with the ewes for about 35 days, but by February 25th lambing is practically over.

As she lambs, each ewe is put in a small pen, about four feet square, in a shed, often a canvas-covered shed. In about 24 hours or less, depending on the necessity of making room for another parturient ewe, she is moved to a larger pen, with four or five other ewes and their newborn lambs. These bunches are then doubled up, until they number about 1,000 ewes and their lambs, or, in case of twins, about 600 ewes. The lambs are usually not branded and marked until they are in bunches of at least half band size.

In order to grow good, early lambs, it is necessary to feed, in addition to large amounts of alfalfa hay, a considerable amount of grain. The ewes with twin lambs will eat up to two pounds of oats a day. The ewes with single lambs are often fed a pound of corn a day. Grain in creeps is provided for the lambs when they are about two weeks of age. Whole oats are a very satisfactory feed for the young lambs after they become accustomed to grain.

ABOUT March 15th, we begin to hope we can turn the ewes and lambs out on grass. When this time comes, a camp tender with his pack string of four mules, a bell mare, and a couple of saddle horses, will start out with two herders and two bands of sheep for the spring range.

Some outfits make a practice of shearing the ewes before they leave the feed yards; shearing late in February or early in March. Most operators, however, shear on the range in April or May.

If the lambs leave the feed yard with a good start, and the spring and early summer range is good, a large percentage of the oldest single lambs will be ready for the market by July 1st. They should be fat by this time, and weigh around 80 pounds.

Most of the forest grazing permits in this section specify an opening date of July 1. There, on tender feed the twins and single lambs that have not been shipped do surprisingly well during good seasons. Those that do not get fat by August 15th are usually weaned and put on pasture or shipped as feeders.

AFTER the lambs are shipped, the ewes are again made up into bands of around two thousand, branded, and the bucks put in with them around late August or early September. Hampshire, Suffolk, and Hampshire-Suffolk cross-bred bucks are the breeds mostly used in this section to produce early lambs.

Generally about two bucks to a hundred ewes are used.

If feed conditions are satisfactory, the sheep are kept in the forests until about October 15th. After leaving the forest,

they are trailed back to the range, used in the spring, or go to pasture. Occasionally, we get early fall rains so that we have green grass pasture, on which the sheep do very well. On dry feed they lose considerable fat they had on their ribs when they left the mountains.

Then, too, we have the coyotes, bear and bob cats, and 10% of our sheep lay down and die or stray yearly. The sportsmen want our summer range for the deer and elk, and the water for the ducks, but sheep raising is a great game and we like it.

Nursery Wagon for Young Lambs with Spring Fever

Generally, in December, the bands will be heading for the feed yards, and we are back to January 1st, where we started a short time ago.

SOME of our veterinary problems may be briefly mentioned. Until we learned how to control foot-rot, we spent about all our spare time whittling on those hard old hoofs, and never did clean it up. Now, we make it a routine practice to put our bands through hot vitriol solution whenever there is the least indication of the disease. We find it a thousand times easier to prevent foot-rot than to cure it.

We also have more or less trouble with "stiff lambs." We have been told it is due to infection through the navel. In some years, this perplexing ailment causes considerable loss. Lambs become "stiff" when they are five days old or five months old, and the symptoms are identical. Lambs born in April in the sage brush and rocks under the hot sun, and certainly under nature's most sanitary conditions, develop identical symptoms to those dropped under admittedly unsanitary surroundings of the early lambing camp.

Nodular Disease

It is the common belief of many veterinary practitioners that nodular worm infestation does not cause serious or fatal disease in sheep. Experience has taught, however, that under certain conditions an infestation with this parasite may be fatal.

It is apparent that sheep, raised in sections where this parasite is prevalent, may not show any clinical manifestations of the infestation. But when these same sheep are transferred into an area where the parasite is not prevalent fatal results occur.

These fatalities are not from the effects of the nodular worm *per se* but are due to an infection in the injured mucous membrane with bacteria to which the sheep are susceptible.

Periodical stomach worm treatment from April to September is of some value against nodular worms, especially if the medicament be given in such manner as to pass on into the intestines without having lost its parasiticide properties in the abomasum.

Fort Worth, Tex. T. O. BOOTH.

Rabies In Relation to the Sheep Industry

By H. W. JAKEMAN,
Boston, Massachusetts

OF THE many infectious diseases affecting sheep, rabies and "sore mouth" formerly designated lip and leg disease, are probably the most significant of the virus group. Rabies, because of manifestations sometimes observed in sheep, may be mistaken for, or at least confused with, plant poisoning so frequently seen in the range country. The finding of Negri bodies by laboratory procedure establishes, of course, a diagnosis of rabies.

The statement has been made that if rabies were controlled in the dog it could be eliminated. This is probably true although there is ever present in some sections its propagation through wild animals. For many years coyotes were a source of danger to the sheep industry but through the efforts of the U. S. Biological Survey and state officials this menace has been greatly reduced. Both wild animals and sheep dogs constitute a possible source of rabies infection in sheep and occasional outbreaks in bands will probably occur for some years.

THE symptoms of rabies in sheep as in all other species show considerable variation. In general they are similar to the symptoms observed in cattle except that the stage of excitement or irritation is more frequenly absent or of very short duration. Unrest, excitement and an aggressive tendency are symptoms to arouse suspicion in an animal which is normally timid and shy. Constant shifting of the weight from one front foot to another, a wild or staring expression of the eyes, possibly a tendency to attack other sheep and running aimlessly are among the earlier symptoms. Bleating, gritting the teeth, salivation, paralysis of the throat with later incoordination and general paralysis ending in death three to five days after the onset is the usual course.

It is interesting to note that in sheep the diagnostic Negri bodies are abundant in Purkinje's cells of the cerebellum. This has been observed in examining the brains of other herbivora whereas in carnivora they are much more readily demonstrated in the hippocampus major or Ammon's horn. This observation, made by the writer in the laboratory examination for rabies of approximately 1500 brains, has led to the theory that in the different species a selectivity of the virus for certain nerve cells exists with the resultant different manifestations of symptoms.

IN CONNECTION with the merits of rabies vaccine as a preventive of the disease the work of Schneider as presented at the annual meeting of the A.V.M.A., August, 1936, definitely established two important facts: (1) the protective value of phenol-killed rabies vaccine was demonstrated on sheep and (2) the intralingual route of administering virus to the test animals affords a suitable means for evaluating the protective value of the vaccine.

This is a long step forward and of tremendous importance in the control of rabies in all species of animals as well as in man. Previous attempts to test the value of rabies vaccine on experimental animals have led to much confusion and in fact were used by the laity as an excuse for opposing the control of rabies by vaccination. It is unfortunate that the results of experiments conducted to determine the value of biological products should be broadcast to the laity, particularly before the findings are conclusive. On several occasions in the past, failure to take into consideration certain fundamental factors in conducting experiments of this kind has resulted in false deductions being made and published—deductions subsequently proved incorrect and inconsistent with results obtained in the field by the practitioner. In most cases the mistake has been in the amount of infective material administered to the test animals or the meth-

od of administering it as compared with natural exposure. All induced immunity is partial or relative. It is a variable degree of increased resistance to a disease and should always be considered as such rather than as absolute. Any biologic agent which increases this resistance to a practical degree under field conditions is of value in the control of an infectious disease.

BASED on the work of the two Japanese investigators, Umeno and Doi, as published in 1918, there has been a tendency to rely on a single injection of rabies vaccine to give a strong immunity for at least a year. This is not dependable. The resistance developed as a result of administering rabies vaccine is increased with each subsequent injection of the vaccine. In other words the greater the number of injections of antigen (vaccine) the stronger the protection or to put it still another way, the degree of immunity is dependent on the amount of brain and cord tissue given providing, of course, that before exposure sufficient time has lapsed for maximum antibody formation to have taken place. It is possible therefore to develop in an animal a degree of immunity approximating 100%. In practice this is not always possible because of economic or other reasons, and seldom, if ever, is it necessary. It should be kept in mind that dosage and frequency of dosage govern the resistance engendered and failure following a single injection should not condemn rabies vaccine.

It has been found that a single injection of rabies vaccine confers a practical degree of immunity for about six months. Each subsequent injection strengthens the resistance and extends the length of time which it persists so that after three or four vaccinations at about six-month intervals, a yearly injection will maintain a resistance which will hold against ordinary bites or exposures.

Driving a Band of 3000 to Market

THE matter of dosage is too frequently overlooked. Rabies vaccines as marketed vary in brain and cord content from 20% to about 33%. The heavier suspensions are more prone to induce mechanical abscesses and are therefore objectionable especially when large numbers of animals are to be vaccinated and it is not practical to distribute the dose. However, by using a site where the subcutem affords ample space for rapid diffusion and by massage, trouble can usually be avoided. In the larger breeds of dogs or those weighing over 40 pounds it is advisable to use 10cc as a dose. This dosage should be given to sheep.

In cases of exposure to rabies the economic or sentimental value must of necessity govern to a large extent the course to be followed. Most exposed animals are destroyed, but if vaccination is to be carried out, quarantine should be established and treatment started at once. It becomes a race between the establishment of sufficient resistance by the vaccine and the virus of rabies reaching the brain via the nerves. A 10cc dose of the "single injection vaccine" should be given daily for six days, although many practitioners modify this by giving two injections the first and second days and continue the treatment longer than six days. If treatment be started early a high percentage of cases will be protected by such a procedure, provided the laceration of tissue has not been extraordinary or the point of infection in close proximity to the brain.

REACTIONS to the vaccine are becoming rare. This is probably due to the finer emulsification of the brain and cord tissue as well as other improvements in production technique. The avoidance

of local reactions is undoubtedly due to greater care being exercised by the practitioner in the selection of a proper site for injection such as the side of the neck just in front of the shoulder, the injection of the vaccine slowly and with sufficient massage to cause its distribution. Leaving the vaccine in a pocket of the subcutem so that a hard lump is felt is bad practice. These points may seem elementary but they are responsible for some of the criticisms directed towards vaccination in the past. Further their practical importance, perhaps, justifies mentioning them.

Some difference of opinion exists as to the relative merits of chloroform-killed and phenol-killed vaccines. Most investigators have failed to demonstrate any difference in protective value. The chloroform-killed product is of necessity a more expensive product. In the vaccination of many millions of dogs during the last 18 years, the phenol-killed product has been the one most used.

FOR some years the practice of conducting clinics in various towns, cities and communities throughout some sections of the country for the vaccination of dogs against rabies has been growing in favor. These clinics are usually sponsored or conducted by city boards of health. For example in Massachusetts there were 70 such clinics held in 1936 in which about 21,000 dogs were vaccinated in addition to those vaccinated privately out of 40,000 licensed dogs in the state. In many towns and cities these clinics have been held annually during the past eight years and it is significant that the incidence of rabies in Massachusetts has dropped to the lowest point it has ever reached, in the many years in which records have been kept. Similar use of rabies vaccine on a large scale both in this country and abroad has been reported from time to time and the results obtained and reported leave no room for doubting the protective merits of rabies vaccine.

THE nature of rabies sets it off from most other infectious diseases and down through the ages many fallacious ideas concerning it have been entertained and still crop up, not only with the laity but in the medical profession. The fact on the one hand that not all individuals exposed to the bite of a rabid animal develop the disease even if untreated and on the other hand the failure of vaccination to protect some individuals results in a difficult situation for evaluating the merits of rabies vaccine under field conditions. However, as pointed out, the vaccination of millions of animals during the past 18 years with the accumulation therefrom of such a vast amount of published evidence is proof conclusive of the great value of vaccine in the control of rabies.

* * * *

Lambs ordinarily gain about one-half pound per day.

The Period of Estrum in a ewe, normally lasts for about two days, and recurs every 16 days.

One ram to every 30 to 50 ewes is considered sufficient in the breeding herd.

The average duration of gestation in a ewe is 145 days or just under five months.

Abortion is usually caused by injuries, fright, moldy feed; occasionally by infection—true contagious abortion. The best thing the practitioner can do in these cases, is to ascertain the cause, if possible; remove it, and advise a change of quarters and feed. Death of the ewe usually occurs from generalized septicemia, due to her weakened condition.

Severe After Pains may result in complete uterine eversion. To prevent eversion, stand the ewe with her head down hill, and give as a douche 20 drops of phenol in one gallon of lukewarm water. Also, hypodermially, give 100cc of calcium gluconate and dextrose solution with a one-twentieth of a grain atropin and lobelin. Keep the ewe standing with the head down hill.

Summary of Sheep Diseases

The 6,812,350 farms in the United States contain around 51,690,000 sheep and lambs. In addition, there are over 5,000,000 goats.

Since 1932, the number of sheep has decreased nearly 2,000,000, due to the drouths of 1934 and 1936. However, the value per head has increased from $3.77 in 1934 to $6.34 in 1936. Lambs and wool have increased in proportion. In other words, 100 sheep worth $400 three years ago are now valued at more than $700.

This upward trend should bring more business to the wide awake practitioner, for sheep, wool, goats and mohair represent nearly a billion dollar industry.

Every section of the country has its own peculiar problems, and these must be met by the local practitioner if his clients are to have confidence in his ability.

The most wide spread of all non-contagious ailments seems to be pregnancy disease in ewes. Of the infectious diseases, hemorrhagic septicemia in its various forms, is the most common. Stomach worm infestation is reported from every state in the union. Only a few favored areas in the high altitudes of the Rocky Mountain plateau are comparatively free from parasites. Poisonous plants are more dangerous in the West, where summer grazing in the national forests is the general range practice, than elsewhere. In the East, dogs are a serious menace, while the coyote is the chief predatory enemy of the western wool grower.

Through the courtesy of the various state officials, and of Doctor Cameron, of Canada, in supplying us with the desired information, we are able to offer the following "birds-eye" symposium:

* * * *

Alabama

Alabama's 275,455 farms contain only 47,000 sheep, mostly Hampshires, Southdowns and Dorsets. They suffer from very few diseases. The chief parasites are the stomach worm and screw worm. About a dozen poisonous plants are found.

I. S. McAdory,
Acting State Veterinarian.

Auburn, Alabama.

Arizona

There are 18,824 ranches and 874,000 sheep in Arizona, the most common breeds being the merino, Hampshire and Rambouillet.

Pregnancy disease; dietary deficiencies; stomach worms; tapeworms; ticks; lice and poisonous plants cause most of the trouble.

C. T. Guilfoyle,
State Veterinarian.

Phoenix, Arizona.

Arkansas

Arkansas has 253,013 farms with 68,000 sheep, mostly Shropshires.

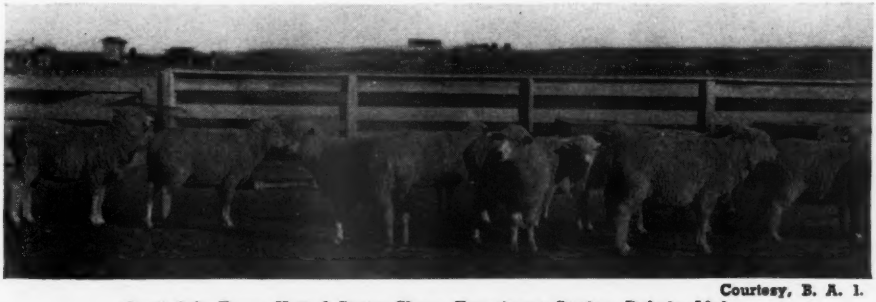
Bronchitis; rhinitis; anthrax; stomach worms and round worms cause most of the trouble. We have few poisonous plants.

C. D. Stubbs,
State Veterinarian.

Little Rock, Arkansas.

California

The second largest sheep raising state in the Union, California, has 3,407,000 sheep on its 150,360 ranches.



Courtesy, B. A. I.

Corriedale Ewes, United States Sheep Experiment Station, Dubois, Idaho

For data on diseases, see "Sheep Raising in California," by Dr. Hugh Cameron.

C. U. DUCKWORTH,
Chief, Division Animal Industry.
Sacramento, California.

Colorado

On the 63,544 ranches in Colorado are found 1,587,000 sheep, with Hampshires, Rambouillets and corriedales the leading breeds.

Over eating in feeder lambs; sore mouth; foot-rot and venereal disease cause much trouble, together with stomach worms, tapeworms, ticks, grub and coccidiosis. Poisonous plants cause considerable loss.

I. E. NEWSOM,
Colorado State College.
Fort Collins, Colorado.

Connecticut

Only 7,000 sheep are found on Connecticut's 32,157 farms, mostly mixed breeds. Acetonemia; nodular disease; hemorrhagic septicemia and foot-rot cause most trouble.

GEORGE E. CORWIN,
Deputy Commissioner of Agriculture.
Hartford, Connecticut.

Delaware

On the 10,381 farms in Delaware there are about 3,000 sheep, mostly mixed breeds. Stomach worms cause the greatest loss.

R. M. SARDE,
Bang's Disease Control.
Dover, Delaware.

Florida

Florida has 72,857 farms with 39,000 sheep, mostly Dorsets. Diseases are uncommon, but parasites cause much loss.

J. V. KNAPP,
State Veterinarian.
Tallahassee, Florida.

Georgia

There are only 34,000 sheep on Georgia's 250,544 farms and plantations.

No report was received from this state.

Idaho

Idaho has 2,104,000 sheep on 45,115 ranches. Rambouillet, corriedale, Hampshire, Lincoln, Cotswold, Suffolk, Panama and Columbia are the leading breeds.

Our sheep are very healthy. Bloat, poisonous plants, some intestinal parasites and predatory animals, are the worst pests.

T. W. WHITE,
State Veterinarian.
Boise, Idaho.

Illinois

We have 704,000 sheep on our 231,312 farms, with Shropshire, Cotswold, Cheviot and Southdown the most common breeds.

Pregnancy disease, hemorrhagic septicemia from the stock yards and internal parasites are our principal troubles.

H. C. RINEHART,
Department of Agriculture.
Springfield, Illinois.

Indiana

Indiana has 782,000 sheep on her 200,835 farms, with Oxford, Shropshire, Southdown, merino, Hampshire, Dorset and Cheviot the leading breeds.

We have a wide variety of ovine diseases and parasites.

J. L. AXBY,
State Veterinarian.
Indianapolis, Indiana.

Iowa

On Iowa's 221,986 fertile farms are found 1,253,000 sheep, with merino, Shropshire and Cheviot predominating breeds.

We have all the common ailments and parasites found in sheep.

H. A. SEIDELL,
State Veterinarian.
Des Moines, Iowa.

Kansas

We have 385,000 sheep on the 174,569 farms in Kansas, mostly Shropshires, Hampshires, Rambouillets, Southdowns and Dorsets. We have the usual common diseases and parasites. Poisonous plants are not important in this state.

R. R. DYKSTRA,
Kansas State College.
Manhattan, Kansas.

Kentucky

There are 1,102,000 sheep on the 278,208 blue grass farms in Kentucky, with the Southdown, Hampshire, Cheviot and Dorset the leading breeds. We are comparatively free from disease; stomach worm infestation being our principal pest.

D. E. WESTMORELAND,
State Veterinarian.
Frankfort, Kentucky.

Louisiana

On the 170,216 farms and plantations in our state, 248,000 sheep are kept, mostly Southdowns and Shropshires.

We have very little disease except anthrax. Stomach worms are a serious menace.

E. P. FLOWER,
State Veterinarian.
Baton Rouge, Louisiana.

Maine

On the 41,907 farms in the pine tree state there are 53,000 sheep, mostly Oxfords, Hampshires and Shropshires.

Diseases are rare, but parasites are prevalent. Dogs and bears are the worst enemies of sheep in this state.

C. H. CRAWFORD,
State Sheep Specialist.

Augusta, Maine.

Maryland

There are about 86,000 sheep on the 44,412 farms in this state, with Hampshires, Shropshires and Southdowns predominating.

We have the usual diseases with a wide prevalence of internal parasites, chiefly stomach worms.

MARK WELSH,
State Veterinarian.

College Park, Maryland.

Massachusetts

Only 8,000 sheep, mostly Dorsets, Shropshires and Southdowns are found on our 35,094 farms.

Disease among sheep is rare, but we have the usual parasites, of which the stomach worm is perhaps the worst.

LUTHER BELDEN,
Massachusetts Sheep Demonstration Farm.

Bradstreet, Massachusetts.

Michigan

On our 196,517 farms there are 1,066,000 sheep. The Oxford, Shropshire, Hampshire, Rambouillet, delaine, merino, Cheviot and Southdown are the leading breeds.

We have a wide variety of diseases and parasites, but little trouble from poisonous plants.

C. H. CLARK,
State Veterinarian.

Lansing, Michigan.

Minnesota

We have 960,000 sheep on our 203,302 farms, of which the Shropshire is the leading breed. We have a wide variety of disease, parasites, but very little trouble from plant poisoning.

C. E. COTTON,
State Veterinarian.

St. Paul, Minnesota.

Mississippi

We have 76,000 sheep on our 311,683 farms and plantations, mostly Southdowns, Shropshires and native crosses. Stray dogs and parasites are our principal pests. As a whole, our state is well adapted to sheep raising.

E. S. BRASHIER,
State Veterinarian.

Jackson, Mississippi.

Missouri

In Missouri, 1,246,000 sheep are found on its 278,454 farms, with the Shropshire, Hampshire, Oxford, Southdown and merino the leading breeds. Since our droughts, dietary deficiencies are our main problem. However, parasites are not to be disregarded at any time.

H. E. CURRY,
State Veterinarian.

Jefferson City, Missouri.

Montana

Montana's 50,564 ranches contain 3,553,000 sheep, of which the Rambouillet, Hampshire, Columbia, Panama and corriedale are the leading breeds.

Our principal troubles are toxemias from improper feeding, foot-rot, big head, ticks, poisonous plants and predatory animals.

W. J. BUTLER,
State Veterinarian.

Helena, Montana.

Nebraska

We have 294,000 sheep (not counting feeder lambs) on the 133,616 ranches in Nebraska. Most troubles are due to improper feeding. This is more noticeable since our recent drouths than ever before.

J. S. ANDERSON,
State Veterinarian.

Lincoln, Nebraska.

Nevada

There are 913,000 sheep on our 3,696 ranches, mostly Rambouillet, Hampshire and corriedale.

Due to high altitude, disease is not common, but poisonous plants are deadly after a hard winter.

EDWARD RECORDS,
University of Nevada.

Reno, Nevada.

New Hampshire

Only 13,000 sheep are found on the 17,695 farms in this state, mostly Southdowns, Shropshires and Cheviot. Disease is rare.

A. L. FELKER,
Commissioner of Agriculture.

Concord, New Hampshire.

New Mexico

On our 41,369 ranches there are 2,037,000 sheep, with the Rambouillet the leading breed. Dust pneumonia, poisonous plants and predatory animals, with some parasites our principal pests.

TOM SNELL,
Secretary, Sheep Sanitary Board.

Albuquerque, New Mexico.

New Jersey

Only 10,000 sheep are found on New Jersey's 29,375 farms, of which the Hampshire, Shropshire and Dorset leads. Very few diseases affect our sheep, but stomach worms are common.

W. C. SKELLEY,
New Brunswick, New Jersey.

New York

On New York's 177,125 farms there are found 455,000 sheep; with the Shropshire, Lincoln and Dorset leading. There is very little disease, but parasites are common. Dogs are the chief menace to the sheep industry in this state.

E. T. FAULDER,
Department Agriculture and Markets.
Albany, New York.

North Dakota

There are 740,000 sheep on our 84,806 ranches. The rambouillet, Hampshire and Shropshire are the leading breeds. We have given more details in our "North Dakota Practice," on page 270.

T. O. BRANDENBURG,
State Veterinarian.
Bismarck, North Dakota.

North Carolina

We have 300,967 farms in this state on which there are some 77,000 sheep, mostly Hampshires, Shropshires and Southdowns.

We have the usual run of sheep troubles, such as pregnancy disease, stomach worms, and some plant poisoning.

WM. MOORE,
Department of Agriculture.
Raleigh, North Carolina.

Ohio

There are 250,146 farms in the Buckeye state on which there are 2,324,000 sheep of almost every breed known. We have practically all the common diseases, parasites, some poisonous plants and sheep-killing dogs. It is my personal opinion that the sheep industry offers an important field of practice for the veterinarian.

F. A. ZIMMER,
State Veterinarian.
Columbus, Ohio.

Oklahoma

Some 190,000 head of sheep, mostly Rambouillet, Shropshire, Southdown, Oxford and Hampshire are found on our 213,325 farms.

We have the usual run of diseases and parasites.

C. C. HISEL,
State Veterinarian.
Oklahoma City, Oklahoma.

Oregon

There are 2,494,000 sheep on Oregon's 64,826 ranches, of which the leading breeds are the Rambouillet, merino, Lincoln, Cotswold, Hampshire and Shropshire crosses.

We have little disease in the main sheep regions, due to the high, dry altitude, but many along the lowlands. Poisonous plants and parasites take a heavy toll in our state.

W. H. LYTLE,
State Veterinarian.
Salem, Oregon.

Pennsylvania

On our 191,284 farms are found 462,000 sheep, mostly Shropshires, Hampshires, Southdowns, Dorsets, merinos, Rambouillets and the Cheviot.

We have the common small farm flock diseases, parasites and some loss from poisonous plants in the mountainous regions.

H. M. KALODNER,
State Veterinarian.
Harrisburg, Pennsylvania.

Rhode Island

Only 2,000 sheep are found on our 4,327 farms. Very little disease is reported. Stomach worm infestation is controlled by routine worming.

J. S. BARBER,
State Veterinarian.
Providence, Rhode Island.

South Carolina

On our 165,504 farms there are only 12,000 sheep, mostly Southdowns, Shropshires and merinos. The usual diseases occur.

W. E. LEWIS,
State Veterinarian.
Columbia, South Carolina.

South Dakota

There are 1,334,000 sheep on South Dakota's 83,303 ranches, with the Rambouillet, Hampshire and Shropshire the leading breeds.

Little disease is reported, but stomach worms do great damage.

T. H. RUTH,
State Veterinarian.
Pierre, South Dakota.

Tennessee

On our 273,763 farms 400,000 sheep are kept. Hampshire, Southdown and crosses are the leading breeds. There is the usual run of disease. Parasites are kept under control by treatment and pasture rotation.

A. C. TOPMILLER,
Department of Agriculture.
Nashville, Tennessee.

Texas

Leading sheep state of the Union, Texas has 7,092,000 sheep on its 501,017 ranches. All the leading breeds are represented. Many diseases, parasites and poisonous plants are prevalent.

T. O. Booth,
State Veterinarian.

Fort Worth, Texas.

Utah

On the 30,695 ranches in Utah, 2,468,000 sheep are kept. For more details see "Sheep Practice in Utah," page 288.

W. H. Hendricks,

Salt Lake City, Utah.

Vermont

There are but 28,000 sheep, mostly Shropshires and Dorsets, on Vermont's 27,061 farms. There is not much loss from disease, but parasitic infestation is quite extensive.

L. H. Adams,
U. S. B. A. I.

Montpelier, Vermont.

Virginia

On the 197,632 farms in Virginia 410,000 sheep are kept, the Hampshire, Southdown and Shropshire predominating.

We have the common small flock diseases, with extensive parasitic infestation. Plant poisoning is very light.

I. D. Wilson,
Virginia Polytechnic Institute.

Blacksburg, Virginia.

Washington

There are 675,000 sheep on our 84,361 ranches; the leading breeds being the Rambouillet, Lincoln, Hampshire, Shropshire and various crosses.

Common diseases are prevalent, with little parasite infestation.

M. R. Hales,
Supervisor, Dairy and Livestock.

Olympia, Washington.

Wisconsin

On Wisconsin's 199,877 farms are found 450,000 sheep, not including feeder lambs. Predominating breeds are the Shropshire and Hampshire. See article "Sheep Husbandry in Wisconsin," page 285.

Walter Wisnicky,
State Veterinarian.

Madison, Wisconsin.

West Virginia

Our 104,747 farms contain 610,000 sheep, with the Shropshire, Southdown, Hampshire, delaine, Dorset and Cheviot the leading breeds.

We have the common run of diseases with widespread parasitic infestation.

J. H. Rietz,
West Virginia University.

Morgantown, West Virginia.

Wyoming

Over 3,341,000 sheep are found on Wyoming's 17,487 ranches: the Rambouillet, corriedale, Hampshire and Cotswold being the leading breeds.

Courtesy, U. S. Forestry Service

Lambing Sheds on an Idaho Ranch

We have the common range diseases and parasites. There is much loss from plant poisoning, especially following a hard winter.

H. D. PORT,
State Veterinarian.

Cheyenne, Wyoming.

Hawaii

About 15,000 sheep are raised on two ranches. Being on high mountain pastures they are quite free of disease.

B. A. GALLAGHER,

Honolulu, Territory Hawaii.

Canada

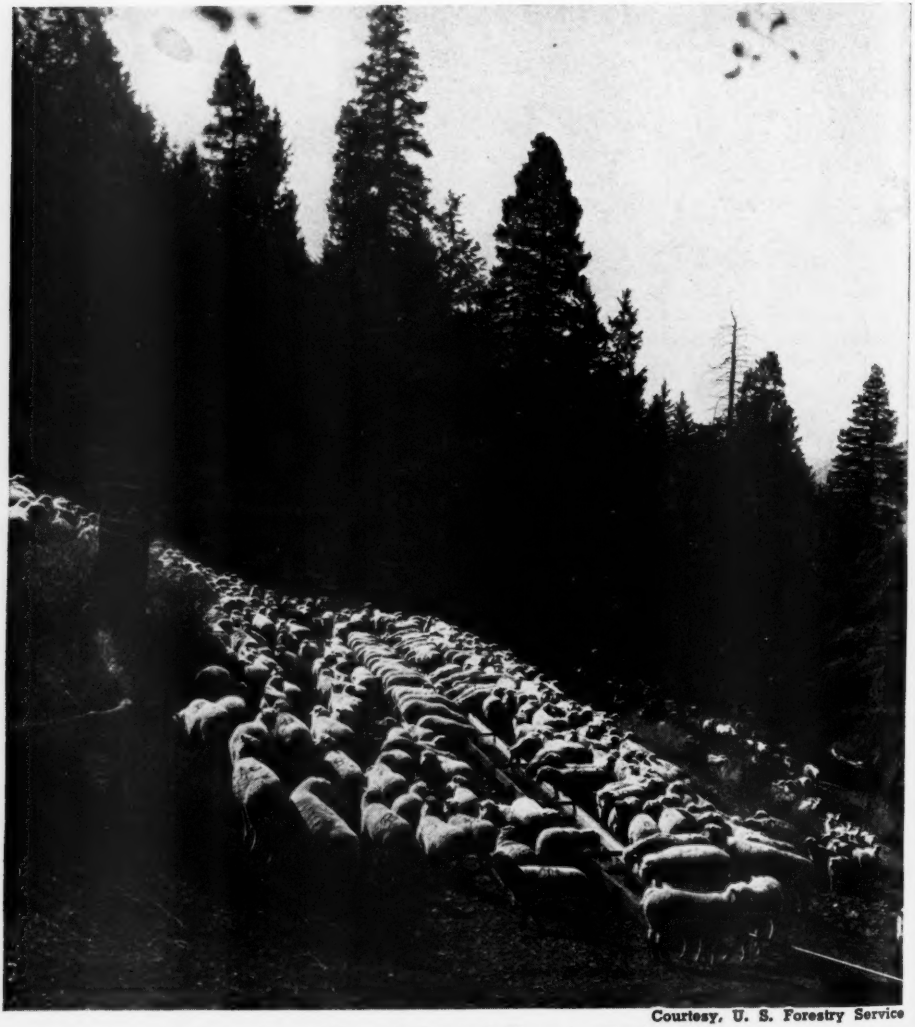
According to the 1931 census there were 728,625 farms in the various provinces of Canada, containing 3,370,000 sheep, of which nearly one-half are in Ontario and Alberta.

In eastern Canada, the Shropshire and Oxford predominate, while in western Canada, the Hampshire, Suffolk, Shropshire and Rambouillet lead.

Eastern Canada has the usual small flock diseases and parasites, while western Canada has the common range troubles.

A. E. CAMERON,
Chief Veterinary Inspector.

Ottawa, Canada.



Courtesy, U. S. Forestry Service

Sheep on Summer Range in Saw tooth Mountains, Southern Idaho